AIR FORCE MATERIEL COMMAND

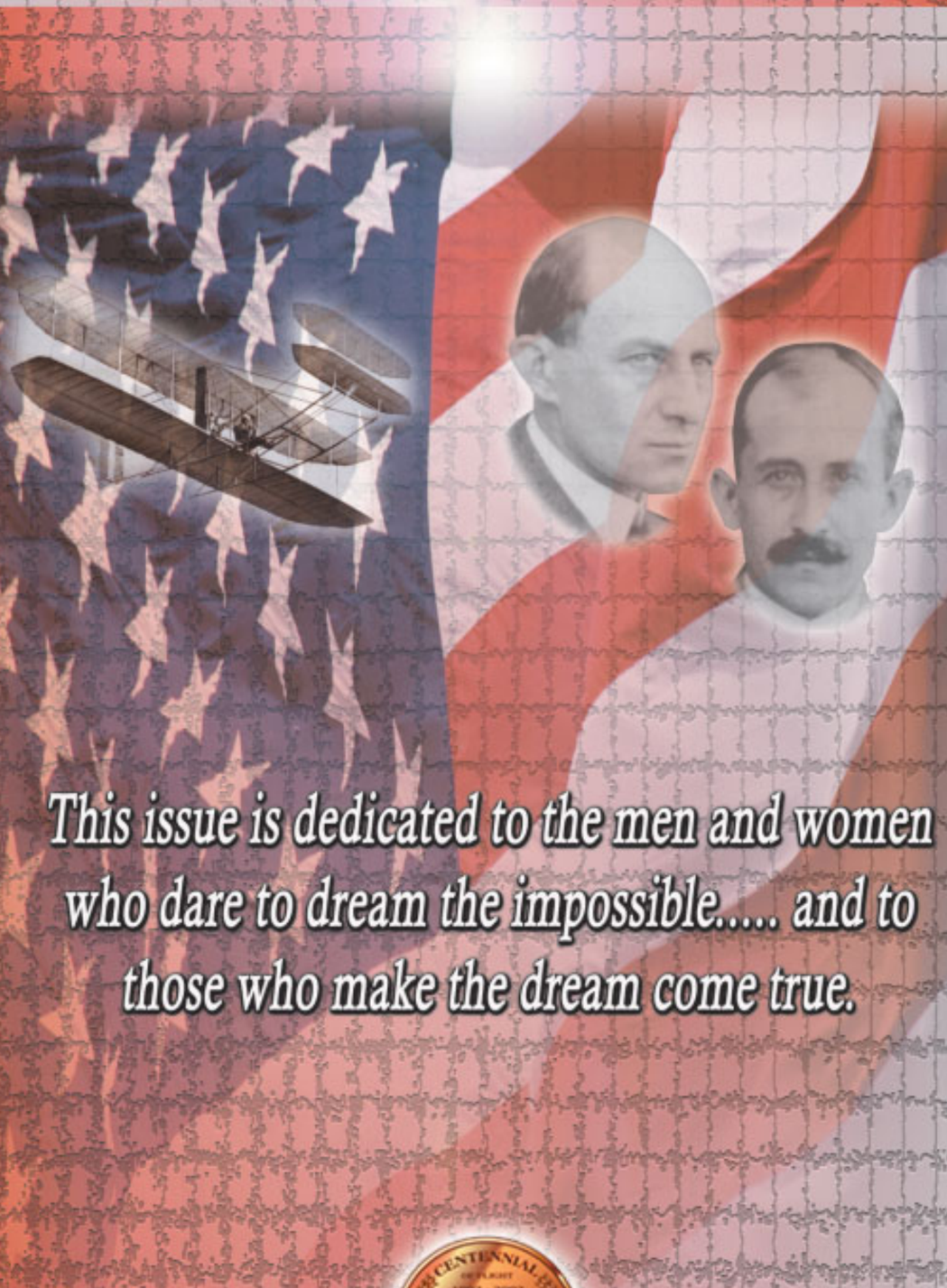
LEADING EDGE

DECEMBER 2002

U.S. AIR FORCE

AIR FORCE MATERIEL COMMAND

BUILDING UPON A CENTENNIAL LEGACY



This issue is dedicated to the men and women who dare to dream the impossible..... and to those who make the dream come true.

CENTENNIAL OF FLIGHT 1903 - 2003 USAF

LEADING EDGE

Headquarters
Air Force Materiel Command
Wright-Patterson Air Force Base, Ohio

Commander
Gen. Lester Lyles

Director of Public Affairs
Col. Donna Pastor

Chief, Internal Communications
Capt. Dave Smith

Executive Editor
Ms. Libby VanHook

Managing Editor
Ms. Estella Holmes

Associate Editor
2nd Lt. Gailyn Whitman

Department of Defense Thomas Jefferson Awards
First Place, Magazine Format, 1996
Second Place, 1998, 1997, 1995

Air Force Media Awards
First Place, Magazine Format, 1998, 1997, 1996, 1995, 1994
Second Place, 2000, 1993, 1992
Third Place, 2001, 1999

This funded Air Force magazine is an authorized publication published monthly for the people of the Air Force Materiel Command. Contents of LEADING EDGE are not necessarily the official views of, or endorsed by, the U.S. Government, the Department of Defense or the Department of the Air Force. The editorial content is edited, prepared and provided by the Public Affairs Office of Headquarters Air Force Materiel Command, 4375 Chidlaw Rd., RM N152, Wright-Patterson AFB, Ohio 45433-5006. The magazine can be found on the Internet on AFMC/PA's home page: http://www.afmc-pub.wpafb.af.mil/HQ-AFMC/PA/leading_edge/index.htm. Photographs are official U.S. Air Force photos unless otherwise indicated. Distribution ratio is 8:1. For submission and writers' guidelines, contact the editor at the above address or DSN 787-7602 or (937)257-1203. Send email to: LeadingEdge@wpafb.af.mil.

Cover stories

Cover illustration by Mr. Wm. Barry Caldwell Wright Patterson Multi-Media Center. Timeline compiled by Ms. Sarah Anne Carter and 2nd Lt. Gailyn Whitman.

4 — 22 AFMC: A century in the Wright direction

Nearly a century after the Wright brothers envisioned propelling a new dimension of human experience and possibility, AFMC keeps advancing technology in support of the Air Force mission. As we move into 2003 and the Centennial of Flight celebration, we pay tribute to all those who develop, acquire and sustain the air and space power needed to defend the United States and its interests — today and tomorrow.

Visit the AFMC Centennial of Flight website at http://www.afmc-pub.wpafb.af.mil/HQ-AFMC/PA/centennial/index.html

Mission Progress

Features

Departments Briefs

Read about Ms. Laura Bush promoting the Defense Department's Troops to Teachers program on page 27.

JDAM contract accelerates new tail kit production

EGLIN AIR FORCE BASE, Fla. — Joint Direct Attack Munition Systems Program Office officials here recently awarded the Boeing Company a $378 million contract for 18,840 more JDAM kits.

The contract calls for Boeing workers to accelerate tail kit production. Currently, workers in Boeing's JDAM assembly facility produce nearly 2,000 kits per month, but they plan to expand to produce 2,800 per month by August 2003.

Boeing has produced approximately 27,000 JDAMs since its assembly facility began operation. Current weapon orders will eventually bring the total to more than 230,000, with each unit costing approximately $20,000.

JDAM is a low-cost guidance tail kit quickly and easily attached to standard 2,000, 1,000 and 500-pound bombs. Its Global Positioning System — Inertial Navigation System capability give it near-precision accuracy in all weather conditions.

— Reported by AAC Public Affairs

ROBE test puts 'Smart Tanker' one step closer

HANSCOM AIR FORCE BASE, Mass. — A KC-135 tanker's first flight equipped with the Roll-on Beyond Line of Sight Enhancement recently allowed Electronic Systems Center experts here to move the Air Force one step closer to its "smart tanker" vision.

The KC-135 demonstrated ROBE's capabilities by relaying real-time situational awareness data between an F-15 Eagle, an E-8C Joint Surveillance Target Attack Radar System aircraft operating over Eglin Air Force Base, Fla., and an operations center hundreds of miles away at Hanscom.

The demonstration showed how ROBE can provide users on the ground and in the air with a common digital battlefield picture that goes beyond the typical line of site boundaries, which have ranged from 200 to 300 nautical miles.

ROBE is the first in a family of Scalable, Modular, Airborne, Relay Terminals, or SMART, that will become increasingly capable as software, programmable radios and advanced multi-plexed antennas become available. SMART terminals will reside on tankers, but will also be suitable for a variety of other platforms to include unmanned and ground or sea-based vehicles. The primary objective is to connect battle directors in the Air and Space Operations Center to the those in-theater or en route wherever they may be.

— Reported by ESC Public Affairs

100th shuttle mission ends with Edwards AFB landing

EDWARDS AIR FORCE BASE, Calif. — The space shuttle Discovery touched down here Oct. 24 wrapping up a 13-day space station construction mission.

NASA was forced to use the backup landing site because of bad weather at Florida's Kennedy Space Center. The mission outfitted the station with a new docking port, the second for U.S. space shuttles.

The crew also added the base piece of a truss system that will eventually support the largest array of solar panels ever flown in space.

— Reported by AFFTC Public Affairs

Joint STARS testing moving surface target engagement at Edwards

EDWARDS AIR FORCE BASE, Calif. — The Air Force's Joint Surveillance Target Attack Radar System, known as Joint STARS, is becoming a familiar site on the Edwards runway.

The aircraft and its test team from Melbourne, Fla., are participating in the Defense Advanced Research Projects Agency's Affordable Moving Surface Target Engagement, or AMSTE program, developed by Northrop Grumman.

The program is demonstrating the ability to precisely engage moving surface targets with modified precision-guided weapons. The Joint STARS, an airborne battle management and command and control platform, is proving key to the AMSTE test program.

In ongoing testing, real-time information on a moving target is developed from standoff radar sensors. The resulting tracking data is relayed from a Joint STARS aircraft directly to a modified weapon system in flight, such as Boeing's Joint Direct Attack Munition, or JDAM, or Raytheon's Joint Standoff Weapon.

— Reported by AFFTC Public Affairs

AFMC: Building upon a centennial legacy

Air Force Materiel Command and its predecessors have enabled the United States to establish and maintain air superiority throughout the conflicts of the past century as underscored by the command's tremendous role in Operation Enduring Freedom and Noble Eagle.

"Every sortie launched, every target confirmed, every bomb dropped and every radio contact completed in our war on terrorism happens because AFMC people continue to anticipate and meet the needs of America's warfighters," said Gen. Lester Lyles, AFMC commander.

Projecting needs

During the current war on terrorism, "AFMC has addressed and forecasted the needs of the warfighter and with few exceptions we have exceeded their needs since then," said Lt. Gen. Charles Coolidge, Jr., AFMC vice commander.

AFMC's people continue to demonstrate the innovation and dedication inspired by the Wright brothers, and the visionaries who followed, which led to the development of air and space resources used to defend the United States and its allies. That continued pursuit to increase warfighter capabilities can be traced through the history of military aviation.

The United States Army Signal Corps, after establishing its Aeronautical Division on Aug. 1, 1907, began to look at the potential of powered flight and its uses during war. In 1908, the Signal Corps announced a specification for an Army airship. It wanted an aircraft that could fly for two hours, carry two people and fly at the speed of at least 20 miles per hour.

By February of that year a contract with the Wrights was signed and the race for air superiority was on.

According to the Air Force History Office, during the years before World War I, military leaders conceived of the airplane as a reconnaissance and artillery-spotting tool.

World War I proved the airplane was better suited as a weapons platform, and by the end of 1918 it was already performing strategic bombardment, interdiction, close air support and airlift missions.

Research and development of the airplane was well underway after the war and metal monoplanes with enclosed cockpits and retractable landing gear replaced fabric-skinned open-cockpit biplanes with fixed wheels. Army engineers designed large bombers and developed a doctrine for their use.

At the start of World War II the need for more advanced aircraft was evident. The result was faster, larger, higher-flying and longer-range airplanes. The war also brought about advances in jet propulsion, ballistic and cruise missiles, pressurized cabins and radar capabilities. The development of the atomic bomb secured the surrender of Japan and suggested that air power could be decisive in the outcome of wars.

The U.S. Air Force

World War II proved the importance of aviation to national defense, and just two years after the war, Congress created an independent United States Air Force.

The end of World War II led to a new kind of war deterring the advances of communist aggression. The new Air Force saw its first victory of the Cold War when it sustained the people of Berlin, Germany, with the largest airlift in history. Throughout the Cold War and still today, Air Force airlift is a major part of humanitarian relief.

During the Cold War, Air Force researchers focused on the development of a strategic nuclear deterrent. Large bombers such as the B-36 and B-52 were developed and partnered with aerial tankers to give the United States the ability to bomb the Soviet Union in one day.

In 1957, the Soviet Union launched Sputnik, the world's first artificial space satellite, into orbit. The U.S. Air Force countered this achievement with the launch of Explorer I in early 1958 and the space race was on.

What's new

New developments in communications, navigation, intelligence and space exploration allowed both countries to explore beyond the earth, sending spacecraft to the moon, other planets and beyond the solar system. Boosters used to launch spacecraft were also used as intercontinental ballistic missiles, which served as a deterrent during the Cold War.

Wars in Korea and Vietnam introduced a new type of enemy. The countries were undeveloped with few strategic targets. New technologies were needed to meet the challenge of guerilla tactics used.

According to the Air Force History Office, among the more dramatic innovations were stealth airplanes, satellite-linked airborne warning and control system aircraft and extremely accurate, precision-guided munitions.

The new precision-guided weapons developed during the Cold War led to a quick victory during the 1991 Gulf War. By 1999, the NATO war with Serbia was conducted entirely with air assets. It was the first conflict to see the use of the B-2 Spirit stealth bomber and Predator unmanned aerial vehicle, which prepared the United States for the new war to come.

AFMC continues to be ready to meet the challenges of war by transforming to provide increased capabilities to the warfighter. New processes of spiral development and horizontal integration shifted the focus from platform-centric to effects-based thinking, allowing capabilities to reach the battle space faster than ever.

According to Maj. Gen. Michael Mushala, Directorate of Requirements and Transformation director, "our command must move toward an expeditionary focus. We must change from a platform-centric planning and execution process to one based on the way we fight as an expeditionary air and space force."

Tomorrow's technologies

Gen. Lyles noted, "I am very proud of the work the men and women of AFMC do on a daily basis! Together, they power the Air Force by providing combat capability. Like their predecessors, they have created and sustained the tools for warfighter success in recent conflicts as well as today's Operations Enduring Freedom and Noble Eagle.

"Each of us must evolve with the global environment to meet the demands of future conflicts. We must make the cultural changes required to be successful. We must continue to deliver tomorrow's technologies in today's weapon systems, faster, cheaper and better," he said.

— 2nd Lt. Gailyn Whitman, AFMC Public Affairs

1903 **Dec. 17, 1903:** Orville and Wilbur Wright flew an airplane for the first time near Kitty Hawk, N.C.

1904 **Sept. 20, 1904:** Wilbur Wright completed the first circular flight at Huffman Prairie near Dayton, Ohio.

1905 **Oct. 9, 1905:** The Wright brothers wrote the U.S.War Department offering their new flying machine to the Army to buy.

1906 **May 22 1906:** The U.S. Patent Office issued a patent on the Wright brothers' airplane.

1907 **Aug. 1, 1907:** The USA Signal Corps established a new Aeronautical Division to take charge of military ballooning and air machines.

1908 **May 19, 1908:** Lt. Thomas E. Selfridge became the first US officer to solo in an airplane.

1909 **Aug. 2, 1909:** The Army accepted its first airplane from the Wright brothers for $30,000.

1910 **March 19, 1910:** Orville Wright opened the first Wright flying school at Montgomery, Alabama, on a site that later became Maxwell AFB.

1911 **Jan. 18, 1911:** Eugene Ely landed on the deck of the USS Pennsylvania, becoming the first pilot to land on the deck of a ship.

1912 **Feb. 23, 1912:** The War Department Bulletin No. 2 for 1912 recognized for the first time the rating "Military Aviator."

Two Wrights plus one mechanic make flight

Over the course of the next year, Americans will celebrate one of the technological feats of the last century. The centennial celebration of powered flight begins this month with a look at the first flight and the men who made it possible.

Most Americans are aware of Orville and Wilbur Wright's heroics, but few know there was a third member of the historic team. Mr. Charles Taylor, a long time friend of the brothers, worked beside them engineering and building the first engine used on "Flyer 1."

Mr. Taylor was associated with the Wright brothers long before they gave him the opportunity to build their first engine. Originally from Lincoln, Neb., he married a family friend of the Wrights, and his wife's uncle owned the Third Street property in Dayton, Ohio, that the brothers rented for their fledgling bicycle business in 1897.

In 1896, Mr. Taylor moved his family from Lincoln to Dayton where he found work at the Stoddard Manufacturing Company, making every thing from farm machinery to bicycles and engines, honing his machining skills.

A professional relationship

He left Stoddard in 1898 to open his own machine shop, and began his professional relationship with the Wrights who provided him bicycle parts for his business. The brothers in turn subcontracted bicycle repair work to him.

After selling his business in 1901, he found work with a local electric company. Meanwhile, the Wright brothers built their first glider. Although the bicycle business was in decline since the introduction of the automobile, the brothers still found themselves in need of a good repairman.

One Saturday Mr. Taylor stopped by the Wright shop to talk and was offered a job. He quickly agreed to work for them, and with a simple handshake, the team that would make history was born.

By the end of 1902, the brothers perfected their glider and were challenged with the process of powering it.

"Processes like casting and welding aluminum, techniques for accurate mensuration, and accomplishment of functions like ignition, carburetion and cooling were all in their infancy," said Mr. Howard DuFour, author of "Charles E. Taylor: The Wright Brothers Mechanician."

According to Mr. Dufour, wind tunnel tests enabled the Wrights to calculate the drag, or wind resistance, of their glider. To overcome the drag, the glider needed thrust. The brothers planned to provide thrust with engine-driven propellers. They needed an engine that would produce a minimum of eight horsepower and weigh less than 180 pounds.

In search of an engine

The Wrights looked to the automobile industry to provide them with their glider's power. They made several requests for an engine, but were turned down by the automakers. One company offered a 130-pound, eight horsepower engine, but the Wrights were unwilling to take a risk on the single stroke engine. They decided they needed to build the engine themselves. The Wrights turned to Mr. Taylor.

Mr. Charles Taylor, who worked in the Wright brothers bicycle shop, built the engine they used on their first successful flight. (Courtesy of Special Collections and Archives, Wright State University)

After several experiments, Mr. Taylor settled on a copper and aluminum alloy to construct the engine. The four cylinders were machined horizontally on a 14- inch lathe.

The result was an engine with 13 horsepower weighing 150 pounds. After completing tests on the engine, the Wrights packed up the engine and glider and headed for Kitty Hawk, N.C., while Mr. Taylor remained in Dayton to manage the bicycle shop.

While assembling the glider and installing the engine, the brothers sent many parts back to him for repair. In essence, he established the first depot maintenance repair facility in aviation history, providing the Wrights with essential repairs and updated parts and supplies as needed.

Success at last

On Dec. 17, 1903, the Wright brothers successfully flew their flyer. Although Mr. Taylor was not there to witness the event, it was his skill and ingenuity that powered the first flight, according to Mr. Dufour. He also built a few of the later Wright engines and traveled with them to provide onsite maintenance while the flyer toured Europe.

Mr. Taylor left the Wright brothers in 1911 to take part in another great aviation first, joining Mr. Calbraith Rodgers in his attempt to become the first aviator to fly from New York to California. After successfully completing the flight, Mr. Taylor returned to Dayton and to the Wright brothers. He stayed with them until 1928 working with experimental aircraft.

Mr. Taylor remained in contact with the Wright brothers over the years as he moved around the country.

His lifelong work in aviation led to his enshrinement in the Aviation Hall of Fame in 1965.

According to Mr. DuFour, a search of relevant literature shows that, in general, Mr. Taylor was more of a supporting actor than a main character in the drama of early flight. His role, however, was crucial to the ultimate success of the first act.

A memorial in honor of Mr. Taylor will be dedicated at Wright State University in Dayton May 24, 2003, to be completed by 2004.

— 2nd Lt. Gailyn Whitman, AFMC Public Affairs

Those 'new fangled' flying machine regulations

A humorous look back at operations of aircraft as set forth by the United States Air Service in 1920.

1. Don't take the machine into the air unless you are satisfied it will fly.

2. Never leave the ground with the motor leaking.

3. Don't turn sharp when taxiing. Instead of turning short, have someone lift the tail around.

4. When taking off, look at ground and air.

5. Never get out of a machine with the motor running until the pilot relieving you can reach the engine controls.

6. Pilots should carry hankies in a handy position to wipe off goggles.

7. Riding on the steps, wings or tail of a machine is prohibited.

8. In case the engine fails on takeoff, land straight ahead regardless of obstacles.

9. No machine must taxi faster than a man can walk.

10. Do not trust altitude instruments.

11. Learn to gage altitude, especially on landing.

12. If you see another machine near you, get out of its way.

13. No two cadets should ever ride together in the same machine.

14. Never run motor so that blast will blow on other machines.

15. Before beginning a landing glide, see that no machines are under you.

16. Hedge-hopping will not be tolerated.

17. No spins on back or tail slides will be indulged in as they unnecessarily strain the machine.

18. If flying against the wind, and you wish to turn and fly with the wind, don't make a sharp turn near the ground. You might crash.

1913 **Aug. 8, 1913:** The Army flew an airplane in Hawaii for the first time.

1914 **Jan. 15, 1914:** The Signal Corps Aviation School established the first safety regulations. It required aviators to wear helmets and coats.

1915 **March 3, 1915:** Congress created the National Advisory Committee for Aeronautics, which eventually became NASA.

1916 **June 18, 1916:** H. Clyde Balsley became the first American aviator to be shot down in World War I.

1917 **Oct. 16, 1917:** The Army tested airplane-to-airplane and airplane-to-ground radio-telephone communication at Langley Field, Va.

1918 **Oct. 2, 1918:** The US successfully flight-tested a pilot-less aircraft called "Bug" at Dayton, Ohio.

1919 **May 19, 1919:** MSgt Ralph W. Bottriell earned the Distinguished Flying Cross by being the first to jump from a plane with a backpack-type parachute.

1920 **June 4, 1920:** Congress' Army Reorganization Act made the Air Service a combatant arm of the Army.

1921 **July 21, 1921:** Army aircraft bombed and sank the captured German battleship Ostfriesland in Chesapeake Bay.

1922 **March 20, 1922:** The Navy commissioned its first aircraft carrier, the USS Langley.

Early aviators risked 'life and limb'

— Col. Nathan Rosengarten
Retired, U.S. Air Force

It was a Saturday evening, March 13, 1943, when Lt. Col. Osmond "Ozzie" Ritland informed me that Sunday would be a fine day for flight testing the first British Mosquito Bomber. I was to be his flight test engineer and observer. I was to meet him at Wright Field Operations the next morning not later than 9 a.m.

These were war years and we were on a seven-day schedule with the objective of accomplishing as much around-the-clock testing as humanly possible.

That morning, for some unexplainable reason, I could not get into my locker so I borrowed a parachute, oxygen mask and a data board from flight operations.

We climbed up the ladder through a small opening in the bottom of the cockpit section. This hole was so small that the backpack chute rubbed against the edge of the hole.

We had no trouble starting the right engine but had difficulty with the left one. In fact, after about a half hour I was certain that we would be forced to abort the flight since the coolant temperature on the right engine was just about against the peg.

Finally, both engines were spinning and it was just a matter of getting the green light to takeoff. There was little question that we better get off at once so we could cool the right engine down to a reasonable temperature.

We were off, flying low and fast before we started our climb. After we reached critical altitude of 18,500 feet, we leveled off and began testing. It wasn't long before I smelled smoke. Looking out toward the left wing, I noticed that we were on fire. The entire aircraft was made of plywood and it appeared that layers of the wing were beginning to separate, like paint peeling off an old barn.

I tapped the colonel on the shoulder and informed him we were burning. He took one look and immediately began emergency procedures. He tried feathering the propeller, hoping to use the fire extinguisher. The propeller would not feather and at the rate the wing was burning, we knew it was time to bail out.

It took only a second for Col. Ritland to give the jump order.

We were flying at 273 mph. Since my seat was a gas tank, I needed very little encouragement to go. I released the bottom hatch and jumped feet first, not the recommended approach. Before my knees cleared the opening, I knew I lost a shoe.

I pulled the rip cord without bothering to count to 10. The parachute was so loose that the chest buckle hit my chin and my forward sight was obliterated by the chest strap sliding up to eye level.

After about a 12-minute descent I was greeted by a group of young boys. One of them told me the pilot had landed, was injured and carted off to the hospital.

This all sounded impossible since I was the first one out of the plane. I wondered what had become of Col. Ritland.

I walked to a farmhouse and called Wright Field. They instructed me to stay put until they could pick me up.

After about an hour, two of our non-plush meat wagons appeared, chugging up the road; they went past me with out stopping. I asked one of the onlookers for a ride to follow the ambulances.

When I got to where most of the debris landed, one of the medics noticed I had only one shoe on. He came to the conclusion I was connected with the crash and insisted I get on the stretcher. Two husky GIs began to lift it, and about three feet off the ground I heard this horrendous ripping sound. The noise was followed by a thud, which was me hitting the ground.

The medics gave up on the stretcher and I was allowed to walk to the ambulance. We took off in search of Col. Ritland, who had been taken to St. Elizabeth's Hospital in Dayton, Ohio.

The medics determined that military men should be cared for at a military hospital. Despite Col. Ritland having a broken back he was moved on a board to another ambulance, and we were both taken to Patterson Field for treatment.

Maj. "Rosie" Rosengarten, chief, flight research at Wright Field, Ohio.

Editors note: Before the establishment of Edwards AFB, Calif., flight testing was primarily done at Wright Field, Ohio. Thanks to a small team of aviation pioneers, the U.S. Air Force was brought into the 21st Century with superior aerospace technology. Air Force retired Col. Nathan Rosengarten recalls his adventures during the 1940s here when he worked with the flight test squadron as a flight test engineer.

As I recall, Col. Ritland was unable to determine how he got out of the plane. Because, there was no time to slow down the plane, I suspect he had to push the control column forward to leave his seat. This put the plane in a dive and when he let go of the column it pitched up throwing him against some part of the cockpit.

Col. Ritland was attempting to exit the plane at the time the airplane blew up. His chute got caught on something and the explosion sent him hurtling from the plane spilling the chute and bending the heavy riser buckle. This accounts for his arrival on the ground before me.

The medics at Building Ten Hospital at Patterson gave us expert treatment. Col. Ritland was healed and back on flying status about seven months after that British Mosquito Bomber fell on American soil.

I never did find my other shoe.

The difference a few hours can make — Sunday morning, March 14, 1943, the first British Mosquito Bomber sits at Wright Field Operations in Dayton, Ohio, before Lt. Col. Osmond Ritland and Maj. Nathan Rosengarten took it up for a test run. During that test flight, the plane caught on fire and crashed into a nearby field. Both the pilot and flight test engineer survived the accident.

1923 **May 3, 1923:** Lts. Oakley Kelly and John Macready completed the first non-stop, transcontinental flight.

1924 **Oct. 28, 1924:** In a fog-dispersing experiment, Army Air Service planes dropped electronically charged sand on cloud formations - the clouds diminished.

1925

1926 **July 2, 1926:** The Air Corps Act redesignated the Army Air Service as the Army Air Corps and created an Assistant Secretary of War for Air.

1927 **May 21, 1927:** Charles A. Lindbergh completed the first solo non-stop flight across the Atlantic Ocean.

1928

1929 **Sept. 24, 1929:** Lt. James H. Doolittle completed the first flight from take-off to landing completely on instruments.

1930 **June 20, 1930:** The Army Air Corps established Randolph Field, San Antonio, Texas, for primary and basic pilot training. It was known as "West Point of the Air."

1931 **April 1931:** Boeing introduced the Y1B-9, its first all-metal low-wing monoplane bomber design, featuring semi-retractable landing gear.

1932 **March 20, 1932:** The XP-26, prototype of hte P-26, first flew. It became the first all-metal monoplane fighter for the Army.

For more than 80 years, Brooks provides pilot care

— Mr. Rudy Purificato
311th Human Systems Wing

Since the early days of powered flight to today's support of America's warfighters, Brooks City-Base, Texas, has played a major role in advancing medical research and training that has helped improve aircrew health and safety.

While Air Force medicine did not begin here, the U.S. Air Force School of Aerospace Medicine's significant contributions to aviation science has been an integral part of Air Force history.

These contributions and others are part of Brooks' memorial tributes to Air Force aviation medical history. USAFSAM's Lyster Hall honors a pioneer who became the catalyst for Air Force medicine. Brooks' Armstrong Research Site is named for another pioneer whose work advanced aerospace medicine.

Lyster and Armstrong shared a common vision: to understand the then unknown forces and conditions affecting human health and safety in flight, and to provide aviators the means by which to survive. Aviation medicine's development as a separate scientific field began out of necessity. It would evolve primarily in San Antonio, Texas, to encompass the needs of countless people worldwide.

Air Force aviation medicine began February 1912, when the War Department inaugurated the first military aviation medical exam. Prior to this "first flight physical," no specialized physical exam for military or civilian pilots existed. Pilots flew at their own risk. The U.S. Army Signal Corps began using the new exam during World War I to qualify pilot candidates for flight duty. Lt. Col. Theodore Lyster, a 41-year-old ophthalmologist, later revised it.

In 1917, Col. Lyster became the Signal Corps Aviation Section's first chief surgeon, responsible for establishing and operating pilot recruitment examination centers. However, he knew that flight exams alone were not sufficient in predicting whether pilots would survive the rigors of flight.

Col. Lyster eventually persuaded Army leaders that a separate, semi-independent medical service was necessary to help safeguard pilots. He envisioned an organization composed of doctors who specialized in aviation's effects on human physiology.

In the beginning...

Col. Lyster and colleague Dr. Isaac Jones also conceived the idea of "flight surgeon." Their idea involved training medical officers in aviation medicine and assigning them to flying units. These "flying docs" would be required to fly with pilots to gain a better understanding of flight dynamic's effects on aviators.

The Central Medical Research Laboratory Lyster had created

The development of a series of physical straining techniques to help pilots tolerate higher G-forces are practiced and perfected in the centrifuge at Brooks City-Base, Texas. (311th HSW photo)

became the site for flight surgeon training. The War Department officially established the flight surgeon career field in June 1918. In July 1919, the first nine flight surgeons graduated from the lab's aviation medicine course.

A growing mission

Following World War I, Col. Lyster's hope for a separate medical service was partially realized in 1920 when Congress passed the Army Reorganization Act. This legislation gave the Air Service control over its own medical research and development programs. On Nov. 8, 1922, the lab's teaching academy became the School of Aviation Medicine, or SAM.

In 1926, the War Department moved SAM to Brooks Field where the Air Service had concentrated its flight training. SAM physicians would also be able to closely study flying cadet's medical problems. A significant number of them had previously washed out due, in part, to pre-existing medical conditions that had not been detected during flight physicals.

"A physical defect which for other branches of the service be unimportant, or a failure to respond to his bodily demands for an increased oxygen supply, may be the cause of disaster to himself, his passenger, his ship and to the innocent bystander," said Capt. C. F. Snell, a 1920s-era SAM staff member, about the importance of aviator-specific physical standards.

As SAM's reputation grew, so did its taskings. In 1926, the school began training medical examiners and flight surgeons for the newly created Department of Commerce's Civil Aeronautics Administration, later Federal Aviation Administration. Many school graduates became early aviation medicine specialists,

Centrifuge keeping pilots safe

Less than 15 years after the first flight, airplanes had become standard weapons. Skeptical of the "new fangled" flying machines and their high rate of accidents, commanders were reluctant to release healthy soldiers to fly.

As a result, pilots were often those who had been wounded or could not pass physicals. It didn't take long to figure out that a soldier had to be as fit to fly as to fight in the trenches.

When Brooks City-Base, Texas, began pilot training in World War I, the gravitational effects, or G forces, on the human body caused by aircraft dive pullouts and sharp turns were not a major concern to aviation researchers. However, pilots were reporting degradation of vision and "fainting in the air" when performing high speed maneuvers.

As the Air Force's aircraft inventory grew more sophisticated and faster, reports of acceleration G force problems increased becoming a more important problem for fighter pilots.

Finding the right vehicle

It was apparent these G force effects could cause accidents with possible loss of aircraft and aircrew. A test vehicle was needed to study these problems in a controlled and safe environment. In 1938, the first such vehicle, a centrifuge was built at Wright Field, now Wright-Patterson AFB, Ohio.

In 1964, the U.S. Air Force School of Aerospace Medicine, installed a large centrifuge at Brooks to study much higher G force effects on humans and to develop life support equipment to help protect aircrews from these effects. Research support equipment was installed to help record human physiological response to high sustained G forces. The centrifuge is operated by the Air Force Research Laboratory, Biodynamics and Protection Division, Flight Motion Effects Branch.

Expanding mission

The primary missions of the centrifuge are to provide a test vehicle for developing and assessing the effectiveness of experimental aircrew G force-protection equipment and methods, and a means for indoctrination and training of aeromedical specialists and other aerospace personnel in the use of these protective techniques.

Initially, the centrifuge could accomplish acceleration up to 1.5 Gs per second, which was adequate to simulate the performance of most aircraft. In 1971, a USAFSAM centrifuge human G tolerance record of 9 Gs for 45 seconds was established using the G-protective equipment and straining techniques developed at USAFSAM. At that time, high performance aircraft such as the F-15 and F-16 were in design and the achievement of this new high-G record helped to prove that pilots could safely fly these new aircraft.

As studies in acceleration physiology continued, it was learned that the rate of G onset, as well as G level, was a very important factor in its effects on humans. It was obvious that the original centrifuge could not simulate the G onset rates of the newer high performance aircraft.

In September 1984, the centrifuge was modified to boost the G-onset rate from 1.5 G per second to 6 G per second and to update the control system and physiological monitoring equipment.

Advancing equipment

Scientists of the flight motion effects branch have developed new protective equipment such as pressure breathing systems, an advanced anti-G suit and valve, physical conditioning programs to increase G tolerance and advanced straining techniques that pilots of the new high performance aircraft needed to survive and perform in the new high-G environment. This centrifuge has also been used to train thousands of aeromedical specialists in the proper use of this equipment and techniques.

The AFRL centrifuge has proven to be a valuable tool to the Air Force and is continuously used by researchers to investigate present and future areas of acceleration effects and protection not even conceivable to the early aviation cadets who flew out of Brooks Field during World War I.

— Mr. Dale Eckroth, 311th HSW Public Affairs and 2nd Lt. Gailyn Whitman, AFMC Public Affairs contributed to this report.

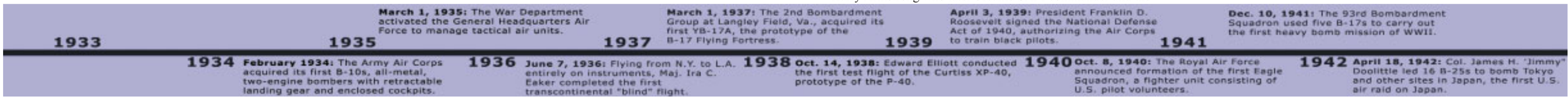
Brooks *continued*

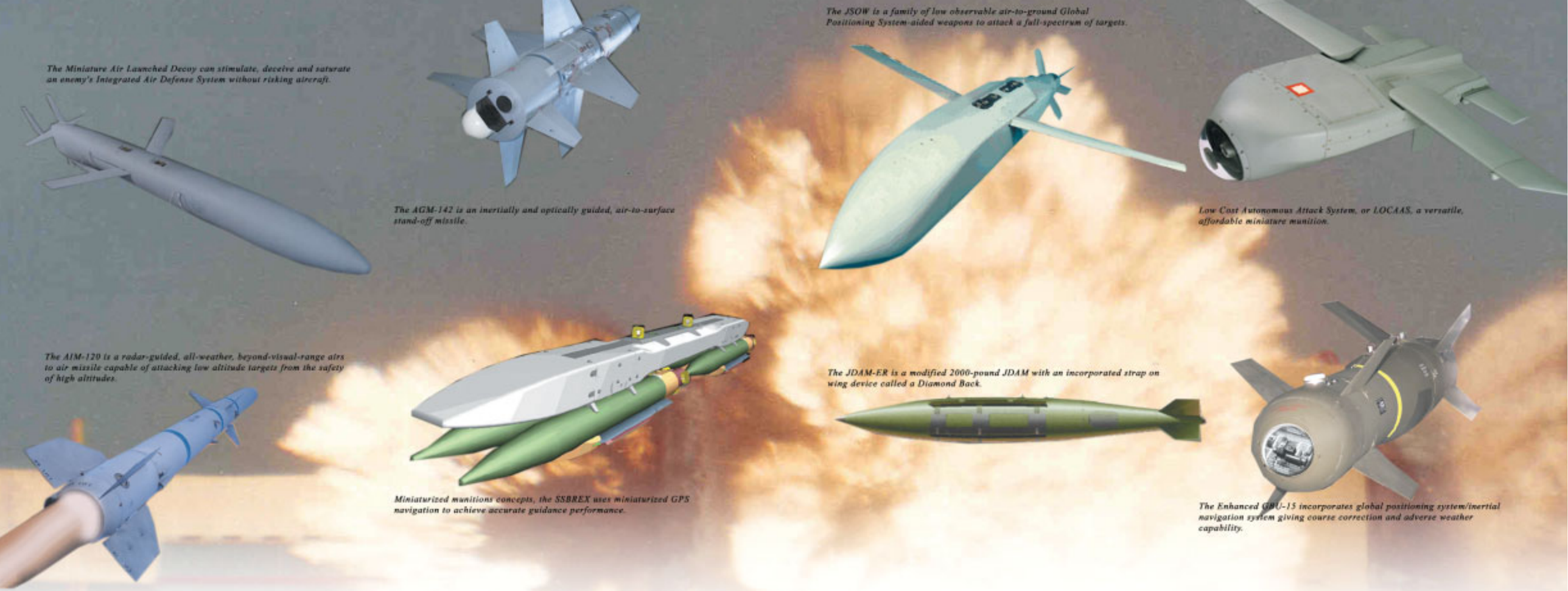
eventually serving as commercial aviation medical directors and consultants.

By 1931, SAM had moved to Randolph Field where it developed into a world-class teaching and research institution. In 1935, the Physiological Research Unit at Wright Field, Ohio, was created. This organization became a research laboratory that collaborated with SAM to develop aerospace medicine.

One of Wright Field's aviation physiology pioneers was Col. Harry Armstrong who later became SAM commander and the Air Force's second Surgeon General. Col. Armstrong was instrumental in creating the world's first Department of Space Medicine in 1949 during the Air Force Medical Service's inaugural year. His vision to create the world's first aeromedical research center led to SAM's return to Brooks in 1959.

During the past 43 years, the school has been at the forefront of major contributions to both aerospace medicine and America's space program.





The Miniature Air Launched Decoy can stimulate, deceive and saturate an enemy's Integrated Air Defense System without risking aircraft.

The AGM-142 is an inertially and optically guided, air-to-surface stand-off missile.

The JSOW is a family of low observable air-to-ground Global Positioning System-aided weapons to attack a full-spectrum of targets.

Low Cost Autonomous Attack System, or LOCAAS, a versatile, affordable miniature munition.

The AIM-120 is a radar-guided, all-weather, beyond-visual-range airs to air missile capable of attacking low altitude targets from the safety of high altitudes.

Miniaturized munitions concepts, the SSBREX uses miniaturized GPS navigation to achieve accurate guidance performance.

The JDAM-ER is a modified 2000-pound JDAM with an incorporated strap on wing device called a Diamond Back.

The Enhanced GBU-15 incorporates global positioning system/inertial navigation system giving course correction and adverse weather capability.

Air Armament Center: The future of weapons technology

The Air Armament Center, Eglin Air Force Base, Fla., has designed and built many of the airborne munitions used by the United States, which has achieved air superiority in every conflict since World War II.

On November 1, 1911, while attacking a Turkish outpost during the Italian-Turkish war, Lt. Giulio Gavotti earned the distinction of being the first to drop air-delivered munitions in combat. During World War I aircrews launched airborne hand grenades, mortar rounds, and even modified artillery shells; however, small payloads and crude bombsights limited aerial munitions from having significant impact on the war's outcome.

During World War II, aircraft became faster and more capable, bombs grew larger and more powerful. Taking their cues from air power advocates Mr. Giulio Douhet and Mr. Billy Mitchell, the U.S. Air Corps Tactical School at Maxwell Field, Ala., devised a strategic bombing theory based on mass bomber formations dropping tons of explosives to destroy targets. While bomber crews carried out the overwhelming majority of these missions with unguided "dumb bombs," the war saw the successful introduction of guided "smart weapons."

One in this series, the 1,000-pound VB-1 AZON, a vertical bomb controllable in azimuth only, featured a tail flare that allowed the operator to guide the bomb to its target.

Bomber crews achieved a measure of success using the VB-1 in the European and China-Burma-India theaters of operation, especially against bridges. However, successful use of atomic weapons at the end of WW II curtailed conventional munitions' development during the subsequent Cold War.

The strategic drawbacks of fission weapons became apparent as the U.S. entered Vietnam in an effort to prevent Communist takeover. This war precluded the use of nuclear armament. The Pave Way program introduced laser-guided technology to destroy targets previously impervious to destruction.

However, during the 1991 Persian Gulf War, video taped images of armament destroying pinpoint targets brought guided munitions to the public's awareness. In addition, the U.S. and its allies also scored multiple air-to-air victories with AIM-7 "Sparrows" and AIM-9 "Sidewinders."

However, in the case of air-to-ground munitions, smoke, dust, and clouds hampered laser-, infrared-, and television-guided technology. Developments to overcome these limitations debuted in the first night of the air war over Serbia when B-2s launched several 2,000-lb. global-positioning system assisted Joint Direct Attack Munition, or JDAM. The stark contrast in munitions can be demonstrated by noting that on average during WW II, it took 900 bombers dropping approximately 9,000 bombs to destroy one 60 x 100 foot target.

Today, the numbers of targets destroyed are limited only by the quantity of precision-guided munitions an aircraft can carry into the fight. The startling change in air-delivered armament is far from over. Scientists, engineers, testers, and acquisition officers work daily to pursue tomorrow's new mission requirements with ever-more effective air armament.

— Mr. Dennis Mills, AAC History Office

1943 **August 5, 1943:** Jacqueline Cochran assumed duties as director of Women Airforce Service Pilots (WASP) a combined training and ferrying unit of women pilots.

1944 **January 8, 1944:** The first U.S. jet aircraft prototype, a Lockheed XP-80 nicknamed *Lulu Belle*, first flew at Muroc Dry Lake, California.

1945 **August 6, 1945:** Col. Paul Tibbits piloted a B-29 called the *Enola Gay* from the island of Tinian in the Marianas to Hiroshima in the first atomic bomb attack in history.

1946 **March 22, 1946:** For the first time an U.S.-made rocket, built by Douglas Aircraft Corporation, escaped the earth's atmosphere, reaching an altitude of 50 miles.

1947 **July 26, 1947:** President Harry S. Truman signed the Armed Forces Unification Act, which created the Department of the Air Force.

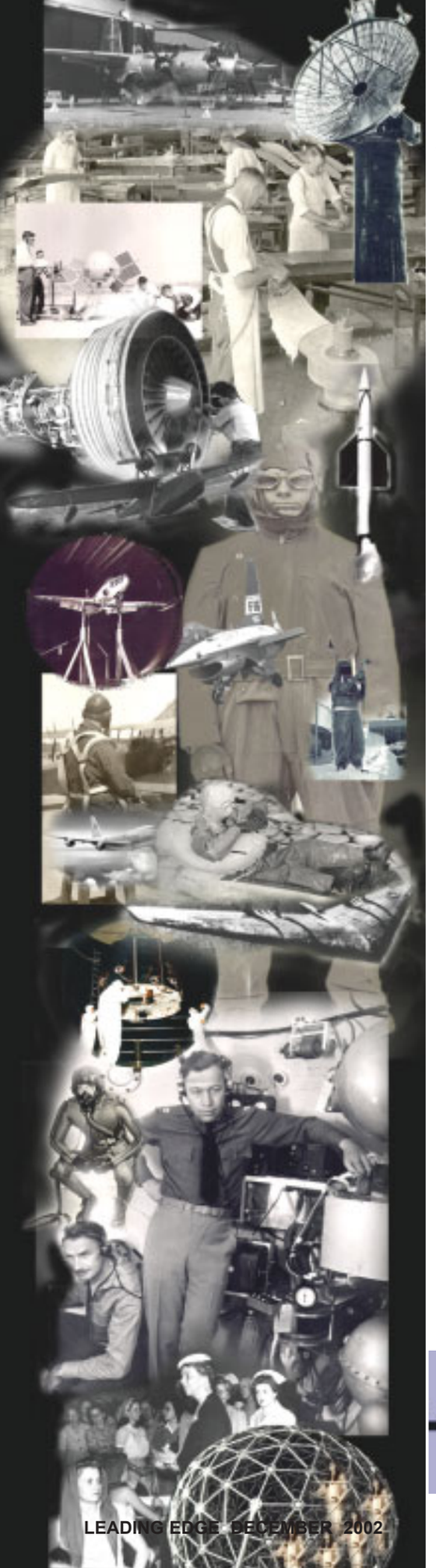
1948 **Dec. 8, 1948:** A B-36 completed a 9,400-mile nonstop flight from Texas to Hawaii and back without refueling.

1949 **April 6, 1949:** The Curtiss-Wright company announced that the Bell X-1 rocket plane, powered by a Curtiss-Wright engine, flew a record 1,000 mph.

1950 **July 24, 1950:** The United States launched its first two-stage rocket *Bumper 8*, which combined a German V-2 missile with a U.S. Army WAC Corporal.

1951 **Sep. 20 1951:** TThe U.S. Air Force for the first time recovered animals from a rocket flight. A monkey and 11 mice survived an Areobee flight to an altitude of 236,000 feet.

1952 **April 15, 1952:** The YB-52, prototype of the eight-jet Stratofortress, the first all-jet intercontinental heavy bomber, first flew.



AFRL moves in the 'Wright' direction

Air Force laboratories have been advancing technology in support of the Air Force flying mission throughout the 20th Century.

Today, the goal remains the same: to provide the warfighter with technologies to ensure the enemy doesn't get a fair fight.

Often referred to as the "Lab," AFRL contributed to the advancement of flight technologies throughout its existence, from the materials used to create air and space vehicles to the engines and fuels that make them go higher and faster.

Maj. Gen. Paul Nielsen, AFRL commander, summarized AFRL's legacy, "The 'Lab' brings our nation's best minds and best technologies to the battlefield, making sure our warfighters have the tools to achieve their mission and to come home to their families."

Streamlining processes

The Air Force science and technology laboratories, once decentralized, were grouped under the newly formed AFRL in 1997 to streamline processes between the laboratories, reduce duplicated efforts and cut the fat. A culmination of events led to the merger of all the Air Force's labs into one entity with 10 directorates, or areas of research, headquartered at Wright-Patterson Air Force Base, Ohio.

AFRL predecessors tested new aircraft ensuring more efficient airframes, propellers, materials, fuels and lubricants were designed and produced. They also focused on improving communications, radio detection finding technologies and airfield lighting systems for the safety of the pilots.

Learning from the past

Armed with the lessons of World War I the "Lab" introduced enclosed cockpits and retractable landing gear to ensure a more aerodynamic craft.

Aircraft engines, fuels, lubricants and propellers were further modified, while photographic reconnaissance techniques and equipment were improved.

Radio detection and ranging radar also emerged from military laboratories during this period.

Research of both the pilot and the aircraft became a main focus. Aerodynamic and static testing technology was advanced; the B-17 Flying Fortress, B-10B Martin and XC-35 Electra were developed. Mr. Harry Armstrong established a lab dedicated to pilot physiology during flight using both an altitude chamber and centrifuge.

"The Human Effectiveness Directorate has provided the training and technologies enabling U.S. airmen to become the world's best in air combat and manned space operations," said Mr. James Brinkley, Human Effectiveness Directorate director.

In the face of conflict

By World War II modifications were made to existing aircraft to meet specific requirements on the battlefield. New aircraft were also developed during this era including the B-29 Super Fortress and P-51 Mustang.

The Air Force laboratories also played a key role in developing a number of new technologies, including airborne radar, the gas turbine or "jet" engine, and the first composite major airplane structures.

Into the future

Following the war, the laboratories led the Air Force into the supersonic age by supporting development of the X-1, the first in a series of postwar experimental aircraft.

"The Air Vehicles Directorate took the Air Force from slow speed biplanes to supersonic jet fighters and bombers. We are on the cutting edge for hypersonic and access-to-space vehicle designs. If it flies, VA had a hand in it!" said Col. Thomas Thacker, AFRL Detachment 1 commander and Air Vehicle director.

During the 1950s the Air Force laboratories continued to support development of high-speed fighter and bomber aircraft, and initiated research into reducing the radar cross-section of air vehicles, research that would bear fruit decades later in the F-117 Nighthawk, B-2 Spirit and F-22 Raptor stealth aircraft.

The 1960s saw a change in emphasis from aircraft capable of high altitude, high-speed flight to the development of more conventional-and capable-tactical aircraft.

Laboratory development of the high-bypass turbofan engine made possible giant transport aircraft, such as the C-5 Galaxy, and later C-17 Globemaster, as well as commercial "jumbo jets."

Laser guided bombs, later used in Vietnam to successfully destroy the infamous Than Hoa Bridge, were also introduced during this decade.

The last quarter century has witnessed the culmination of many earlier developments fostered by the Air Force laboratories. High performance fighters like the F-15 Eagle and F-16 Fighting Falcon would have been unthinkable without contributions in materials, aerodynamics, controls, human factors, and propulsion technologies.

The lab has been developing Command, Control, Communications and Intelligence, or C3I, technology that harnesses information in near real time for the warfighter. New systems like the Airborne Laser Laboratory and stealth aircraft showed why such C3I was essential.

Meanwhile, distributed computing systems like the Advance Research Projects Agency Network established the technology to link Air Force assets around the world and laid the basis for what would become the Internet.

"The Information Directorate has taken warfighters from vacuum tubes and grease pencils to state-of-the-art information technology," said Mr. Raymond Urtz, IF Director.

21st Century

According to Gen. Neilsen, "Each AFRL directorate has a rich history of contributions to building today's Air Force and together we are building the nation's Air Force of the future." The men and women of AFRL are not usually at the tip of the spear. Instead, we defend America by unleashing the power of innovative science and technology," he said

— 2nd Lt. J. Elaine Hunnicutt (The Aeronautical System Center History Office contributed to this article).

1953

Sept. 1, 1953: The USAF announced the first in-flight refueling of jet-powered aircraft by jet-powered aircraft. A KB-47 refueled a standard B-47 Stratojet.

1954

March 1, 1954: The U.S. exploded the first hydrogen bomb in the Marshall Islands. A fusion weapon, the hydrogen bomb was many times more powerful than the atom bomb.

1955

February 26, 1955: George Smith, a test pilot, ejected from an F-100 Super Sabre traveling at Mach 1.05, becoming the first to survive ejection at supersonic speed.

1956

November 30, 1956: A Martin TM-61 Matador, a jet-propelled missile,completed its final test flight and became the USAF's first operational tactical missile.

1957

June 11, 1957: The first U-2 high-altitude longe-range reconnaissance aircraft was delivered toLaughlingAFB, Texas. The U-2 can fly 10 hours at a speed of 600 mph.

1958

January 31, 1958: Explorer I, the first U.S. satellite to go into orbit was launched by a Jupiter C rocket from Cape Canaveral, Florida.

1959

June 8, 1959: An experimental X-15 rocket airplane took its first flight after being released from a B-52. The X-15 could reach the edge of outer space and reach speeds up to 4000 mph.

1960

April 1, 1960: TIROS 1 (Television Infared ObservationSatellite,) the world's first meteorological satallite, was launched from Cape Canaveral, Florida.

Principles, ideas confirmed by nation's history

— Mr. Charles Metcalf
Director, U.S. Air Force Museum

Nearly a century ago, a couple of enterprising brothers from Dayton, Ohio, had the audacity to envision man unfettered from gravity's constraints, taking flight not only into the sky but into a new dimension of human experience and possibility.

As is the case with most pioneers, they encountered critics and confronted obstacles, but an unyielding spirit of persistence carried Wilbur and Orville Wright over the flood of doubt and lifted them and humanity into the era of manned, powered flight.

History of kindred souls

In 2003, Dayton, the nation and the world will celebrate the Wright brothers' legacy and the aviation tradition they ignited.

Since that first flight at Kittyhawk, N.C., other kindred souls possessed of the same desire to push back the technological wilderness have engaged in the effort to extend even further during the last 100 years what the Wrights achieved. It is their accomplishments, and character that we'll celebrate every bit as much as we will those of Dayton's favorite sons.

As director of the U.S. Air Force Museum, I am intimately acquainted with this century-young story.

As the National Museum for the Air Force and the world's largest and oldest military aviation museum, we join the effort each day to tell the world the story of military aviation visionaries and heroes.

Public embraces history

Each year, more than 1.2 million people visit the museum and more than 45 million visit our Web site to explore for themselves the history of our nation's Air Force and military air arm.

Walk through our galleries and an impression that strikes you is man's continuing drive to imagine greater possibilities and to translate dreams into accomplishments.

Consider our world-class collection of more than 300 aircraft and missiles and more than 6,000 display artifacts spanning all eras of military aviation history.

A visitor can walk through the museum, starting with the reproduction of the 1909 Wright Military Flyer in our Early Years Gallery and end with aircraft such as the YF-22, prototype of the Air Force's stealthy next-generation air superiority fighter F-22 Raptor, and the B-2 Spirit stealth bomber.

Additionally, a prototype of the Joint Strike Fighter will join the collection. The substantial history these aircraft bridge illuminates the astounding technological progression in military aviation over the last century.

But what's so important about this story? And, as I'm sometimes asked, why such a large museum devoted to telling such a story?

Certainly, history can make for interesting trivia and story telling, but it is, well, history.

Learning lifes' truths

The truth is, history is more than just a random recall of dates, people and events. History confirms our national ideals and principles. History teaches each generation the necessity of vigilance and sacrifice.

When thoughtfully considered, history's lessons often bring clarity in confusion, courage amid fear, direction in place of aimlessness and conviction over lack of resolve.

In this sense, history is not just who we've been, but who we are, who we can become and how to take up the journey.

This story the museum seeks to safeguard and portray spans generations, connecting its members to a shared tradition of duty, honor, and, yes, sacrifice.

The weapons of warfare may differ from one generation to the next, but the desire and requirement to innovate in the interests of national security and, by extension, global stability, do not.

Galleries, teaching tools

This is a critical lesson our galleries convey. We don't tell the stories of aircraft; instead, we use aircraft and increasingly sensory-rich exhibits to tell the story of people who, out of patriotic resolve, conceived, designed, employed, maintained and supported systems and capabilities that have made the U.S. Air Force the greatest in the world and helped forge America's identity as the world's greatest guarantor of democracy.

Now, our nation and the civilized world are engaged in a struggle to eradicate terrorism. It's no small task and doesn't promise to be a short one.

Again, America is called upon to lead by her innovation, by her technology and, most importantly, by her ideals and principles, employing them as a force for good.

History suggests that we can and that we have. America's commitment to liberty and her status as the world's lone superpower demand that we must. Seeking to more dramatically and effectively tell this story of innovation, vision and service, the museum has embarked on a major expansion.

The expanding phase

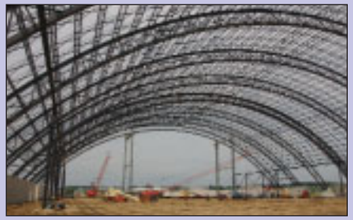
Currently, we're constructing a 200,000-square-feet third building scheduled to open in spring 2003, with additional expansion phases to include a hall of missiles, a space gallery and an education center.

It's all part of better performing our mission of educating the public, particularly younger generations, that a nation that desires to remain free is one that must always be devoted to the pioneer ethic and the patriotic impulse.

When 2003 rolls around and the Centennial of Flight Celebration kicks into high gear, we will commemorate the Wright brothers' achievement, as well we should.

But as we do so, let us recall and celebrate the story in its broadest dimensions by recognizing inherent themes that anchor that story — innovation, vision, daring, courage, conviction, honor and service.

They served the Wright brothers well. If we heed them, they will do the same for us.



Museum Expansion aligns with 2003

The expansion and re-creation of the Air Force's national museum is gathering momentum and is on course to intersect with the 2003 Centennial of Flight celebration.

The U.S. Air Force Museum is constructing a new 200,000-square-feet third hangar, taking steps to revamp the museum's gallery layout and preparing for an intense menu of major special events.

It all adds up to a landmark year for the institution, according to museum officials.

The new hangar, opening in spring 2003, is already designated the Eugene W. Kettering Gallery. Mr. Kettering was another Dayton native son. The building will house the Cold War Gallery, intimately portraying the military, technological and geopolitical developments of the era and emphasizing the Air Force's crucial role in Soviet containment and the eventual triumph of democracy at the end of the Cold War.

The new building is the centerpiece of the museum's expansion vision, with additional phases to include a hall of missiles, a space gallery and an education center.

Accentuating its 2003 celebration, the museum will stage a variety of major events and programs throughout the year to commemorate the Centennial of Flight. Many are museum initiatives, although two are initiatives of Dayton-based Inventing Flight, the organization spearheading the area's 2003 celebration

— Mr. Chris McGee, US Air Force Museum Public Affairs

1963 **July 26, 1963:** *Syncon 2* became the world's first satellite to be placed in geosynchronous orbit. It orbited at the same speed as the Earth, keeping it in the same location.

1964 **July 28, 1964** The number if SAC ICBMs equaled the number of bombers on ground alert, for the first time. Later the ICBMs would surpass the bombers as a nuclear deterrent.

1965 **July 14 1965:** NASA's *Mariner 4* after a November 1964 launch, reached the vicinity of Mars, becoming the first spacecraft to send close photographs of the red planet back home

1966 **June 2, 1966:** *Surveyor I* became the first U.S. spacecraft to make a soft landing on the moon.

1967 **March 15, 1967:** The SikorskyHH-53B, the largest and fastest helicopter in USAF inventory, made its first flight.

1968 **August 25, 1968:** The North American OV-10 Bronco, the USAF's newest forward air control aircraft, began a 90-day combat evaluation program in South Vietnam.

1969 **July 20, 1969:** *Appolo 11* crew members Neil Armstrong, a civilian, and USAF Col. Edwin E. Aldrin, Jr. became the first men to walk on the moon.

1970 **June 6, 1970:** USAF Military Airlift Commandaccepted delivery of the first C-5 Galaxy (the largest operational airplane in the world at that time.)

1971 **July 29 1971:** The Air Force completed its flight tests of the experimental X-24A lifting body. Data from these tests contributed to the development of the NASA space shuttle.

1972 **April 27, 1972:** USAF released Paveway 1 laser-guided "smart" bombs,destroying the Thanh Hoa bridge in North Vietnam, for the first time in combat.

Rocket propulsion's role in Air and Space Force

While early aviation developments were occurring, a vision of explorations beyond the bounds of earth drove a small cadre of engineers and scientists to pursue rocket propulsion concepts to allow them to send payloads and perhaps mankind on rockets to far-away destinations.

Dr. Robert Goddard was pursuing his new liquid rocket propulsion system soon after the Wright Brothers had taken flight. Soon he was able to launch and demonstrate his new propulsion system. As the size, complexity and range of his rockets increased, he moved to a remote launch site in the New Mexico desert.

In the meantime, Gen. Hap Arnold's collaboration with scientists and visionaries of his era, coupled with his personal knowledge of a location in California's Mojave Desert, known then as Muroc, helped establish a plan in 1947 for a rocket test facility in the northeast corner of Edwards Air Force Base, Calif.

Today, the Air Force Research Laboratory's Edwards Research Site, known to oldtimers as the "Rocket Site," pursues a broad range of rocket technologies in its labs and test facilities. Almost every American rocket used to launch payloads or munitions can trace its technology or testing to the facility.

It was completed in the early 1950s and was soon busy testing propulsion systems. In a quest to meet increasing range and payload requirements, the liquid rocket propulsion systems for Thor and Atlas ballistic missiles were being integrated and fired on massive static rocket test stands that overlook the dry lakebed at Edwards.

In 1959, when rocket propulsion researchers from Wright-Patterson AFB, Ohio, had run out of room for their experiments and exotic propellants, they joined test engineers at the isolated and secure location at Edwards. The unique facilities were essential for the initial test launches of the Minuteman I ballistic missile. The lab's advanced planning and research efforts lay the groundwork for another national need — the propulsion system necessary to propel man to the moon. Each F-1 rocket engine generated 1.5 million pounds of thrust and generated 3-tons of liquid oxygen and kerosene per second on huge test stands that are still being utilized today.

More than 7,000 firings of the F-1 and its components took place at the facility. It took five of the engines to propel man to the moon and much other technologies to assure their safe return to the earth.

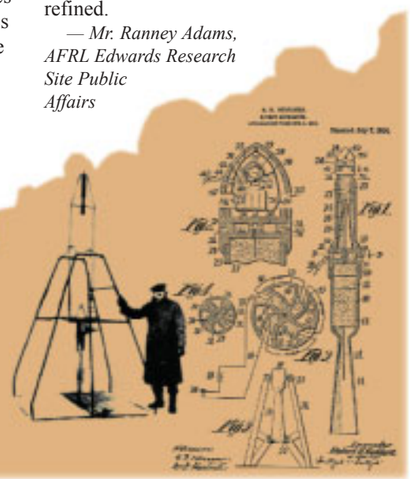
There were parallel paths for solid rocket developments. Ballistic missile innovations were pursued to increase their range and capabilities. These developments soon paid off with the Peacekeeper and small intercontinental ballistic missile systems, the basis of today's Pegasus launch system.

Lab researchers provided countless innovations that basically doubled the performance of the systems with new propellants, case materials, carbon nozzles and launch techniques.

Many of those innovations were applied to solid rocket boosters needed to increase the payload capacity of Titan and Delta launch systems. The first segmented solid rocket booster was fired in 1975 on the Lab's thrust test stand.

Currently the largest solid boosters are capable of 1.7 million pounds of thrust and are used for the Titan IV. Tomorrow's technologies include the pursuit of advanced propulsion methods for space like electric and solar propulsion. Innovations like laser propulsion where a spacecraft is propelled by a powerful laser beam into space are being tested and refined.

— Mr. Ranney Adams, AFRL Edwards Research Site Public Affairs



Aircraft propulsion celebrates a century of power for flight

One hundred years ago, Orville and Wilbur Wright set out to solve the problem of flight. History has proven their methodical experimentation with kites and gliders evolved into one of mankind's greatest inventions — powered aircraft.

What the Wrights' created in 1903 was a reliable propulsion system producing 13 horsepower that provided the thrust necessary for takeoff, climb and sustained level flight.

Today, as the centennial of their first powered flight on Dec. 17, 1903, draws closer, Air Force Research Laboratory scientists, engineers, contractors, engine manufacturers and university researchers continue to expand the envelope of propulsion technologies with their own inventions that push aircraft higher, faster and farther than Orville and Wilbur ever could have imagined.

A special celebration

Celebrating a "Century of Power for Flight," nearly 700 Defense Department, NASA and aerospace industry participants met Sept. 9-12 in the Wright brother's hometown, Dayton, Ohio, to explore and exploit the latest propulsion technology advances that will preserve America's dominance in the air. The biennial event is sponsored by AFRL's Propulsion Directorate, Wright-Patterson AFB.

The forum gave the U.S. turbine engine community a chance to review and discuss the latest technology advances achieved through programs like integrated high performance turbine engine technology, or IHPTET, and versatile affordable advanced turbine engines, or VAATE.

And just as the Wright Brothers had a clear concept of the role of engines in their aircraft — to provide reliable, sufficient power — their modern day counterparts share that passion.

"We are committed to providing the nation with propulsion and power technologies that will change the future of air, space and weapons," said Col. Al Janiszewski, propulsion director.

With more than 450 ongoing programs, 1,000 people and an annual budget of more than $300 million, the propulsion directorate provides a complete spectrum of advanced propulsion technologies for the nation's military services, he said.

Besides providing propulsion technologies for aircraft, rockets and spacecraft, the directorate also conducts leading edge research and development in aerospace fuels, propellants and power generating systems.

Mixed in with the symposium's seminars and special presentations on the future of engine durability and warfighter readiness, attendees also got a rare glimpse of their roots with a demonstration of Orville and Wilbur's 1910 Wright Vertical Four aircraft engine, the only operating original Wright engine in the world.

Mr. Greg Cone adjusts the speed of the only operating original Wright engine in the world — a 1910 Wright Vertical Four, Serial # 20. The engine was started for the first time in 85 years in 2000 and will fly again in 2003 in a newly built model "B" Wright Flyer. (U.S. Air Force Photo by Mr. Bill McCuddy)

Owned by the Wright Experience, a non-profit charitable organization which seeks to rediscover the Wright Brothers experimentation, discovery, and methodology, the 92-year-old engine was collected in 1999 and restored by Mr. Greg Cone of Warrenton, Va. The "Vertical Four" was the Wrights' mature engine design, and was the standard powerplant for their most produced airplane, the Model "B" — the world's first production airplane.

A shared passion

The engine was started for the first time in 85 years in 2000. Since then, the engine has been demonstrated numerous times, but never to a more appreciative crowd of engine lovers than symposium attendees who share the Wrights' vision to explore the engine technologies that power the future of flight.

"Staying connected with our tremendous heritage is a very real priority in the engine community," said Col. Janiszewski. "We do this, first, through events like this working demonstration of the Wright brothers' engine.

But in a much more important way, we do it by sharing the same incredible sense of innovation the Wright brothers displayed by developing revolutionary technologies that make today's Air Force second to none," he said. "We honor our past while creating our future."

— Mr. Michael Kelly, AFRL Propulsion Directorate

1973 **Dec. 3, 1973:** *Poineer 10* became the first space probe to reach the vacinity of Jupiter.

1974 **Dec. 23, 1974:** The B-1A Bomber made its maiden flight traveling from Palmdale to Edwards AFB, Calif.

1975 **January 13, 1975:** The General Dynamics YF-16 prototype was selectd as USAF's air combat fighter, a low-cost, light-weight, highly maneuverable fighter aircraft.

1976 **January 9, 1976:** The first operational F-15 Eagle was delivered to Langley AFB, Virginia.

1977 **August 12, 1977:** Released at an altitude of 22,800, from the top of a Boeing 747, the *Enterprise* completed the first space shuttle descent and landing.

1978 **February 22, 1978:** The U.S. launched with an Atlas booster the first Global Positioning System (GPS) Satellite.

1979 **June 12, 1979:** A cyclist named Bryan Allen made the first human-powered flight across the English Channel in the aircraft *GossamerAlbatross*.

1980 **Sept. 18, 1980:** An explosion destroyed the 308th Strategic Missile Wing's Titan II launch complex 374-7 in Little Rock, Arkansas.

1981 **January 11, 1981** The Boeing Company delivered the first USAF air-launched cruise missiles. Capable of delivering a nuclear weapon 1,500 miles away, and could aviod enemy radar by flying low to the ground.

1982 **November 11, 1982:** The fifth space shuttle mission was the first to fly into space with four persons aboard.

Hanscom celebrates AWACS anniversary

Recently leaders from the acquisition industry came together at Hanscom Air Force Base, Mass., to celebrate the Airborne Warning and Control System Program Office's silver anniversary.

Throughout its 25-year history AWACS has proven itself both on and off the battlefield to be a premier command and control aircraft used by commanders of U.S., NATO and other allied air defense forces.

Early development

The E-3 Sentry aircraft is a modified Boeing 707/320 commercial airframe with a rotating radar dome. Inside the dome is a radar subsystem that permits surveillance from the earth's surface up into the stratosphere, over land or water.

The E-3 was originally conceived to overcome the line of sight limitations of ground based radar systems.

At the time of its development AWACS was the first program to test the feasibility of a revolutionary new Air Force contract philosophy "fly before buy," setting a new standard for acquisition. Under this concept the Boeing, the prime contractor, would have to provide a viable end product, flown, tested and thoroughly analyzed before the initial delivery would take place.

Evolving mission

The AWACS radar has a range of more than 250 miles for low-flying targets and farther for aerospace vehicles flying at medium to high altitudes. The radar, combined with an identification friend or foe subsystem is able to detect, identify and track enemy and friendly low-flying aircraft by eliminating ground clutter returns that confuse other radar systems.

The first E-3 aircraft was delivered to the Air Force on March 24, 1977. Its primary mission prior to the end of the Cold War was as an airborne early warning radar, alerting North American Aerospace Defense Command to the approach of Soviet Union bombers if they flew toward the United States or Canada.

"AWACS has been involved in every major operation over the last 25 years," said Lt. Col. Bob Hartnett, chair, AWACS 25th Anniversary Planning Committee. "It is simply an asset our nation counts on every time for surveillance, weapons control, and battle management."

The E-3 was one of the first aircraft to deploy during Operation Desert Shield where they established an around-the-clock radar screen to defend against Iraqi aggression. During Desert Storm, E-3s flew more than 400 missions, logged more than 5,000 hours of on-station time, provided radar surveillance and control to more than 120,000 coalition missions and assisted in 38 of the 40 air-to-air kills recorded during the conflict.

Major modifications

During the spring of 1999, the U.S. and NATO partnered a developmental program involving a major hardware and software-intensive modification to the existing radar system enhancing the operational capability of the E-3, and improving the system's reliability, maintainability and availability.

Last year the E-3 AWACS fleet completed a major 14-year upgrade known as the Block 30/35 Modification Program. The upgrade added a new electronic listening capability to AWACS to identify unfriendly radar targets up to 300 nautical miles.

"The AWACS Program Office continues to deliver cutting edge capability to the nation. These airborne warning and control capabilities are second to none," said Ms. Virginia Williamson, deputy Air Force program executive officer for Command and Control and Combat Support Systems.

And finally, the AWACS fleet continues to support the nation's air and space mission. Following the tragic events of Sept. 11, 2001, NATO's AWACS aircraft were deployed to patrol North American airspace, freeing up U.S. E-3's to deploy oversees in support of Operation Enduring Freedom. And later that same month, AWACS were deployed to a forward location in support of Operation Enduring Freedom.

— Ms. Rhonda Siciliano, ESC Public Affairs

Tinker sustains Wright's aviation standard

While most people think of Wilbur and Orville Wright as the fathers of powered flight, some at Tinker Air Force Base, Okla., think of them as the fathers of airplane repair and maintenance.

Before they successfully got their flyer off the ground, the Wrights spent countless hours repairing, restructuring and modifying the aircraft's structure and design. The Oklahoma City Air Logistics Center has been continuing that work for 60 years now.

The history of Tinker's support to the warfighter and the aviation industry itself began when the Army Air Forces awarded the Douglas Assembly Plant to Oklahoma City in January, 1942.

The giant plant eventually employed 24,000 people and churned out C-47 cargo planes in support of World War II. From March 1943 to August 1945, the plant produced 5,354 C-47s and spare parts for 500 more. It also assembled 400 C-54 cargo planes and 900 attack bombers.

The beginning of an era

Maintenance personnel passed an impromptu test of their skills in September 1942 when the first engine and fuselage was repaired — a Navy S03C-1Scout, the first aircraft repaired at the Oklahome City Air Depot, that had been damaged by a fire. Tinker fixed the crippled plane and got it airborne once again. The first scheduled repair project began later that month.

In 1946, Tinker personnel found themselves making history by preparing B-29s for atomic bomb tests.

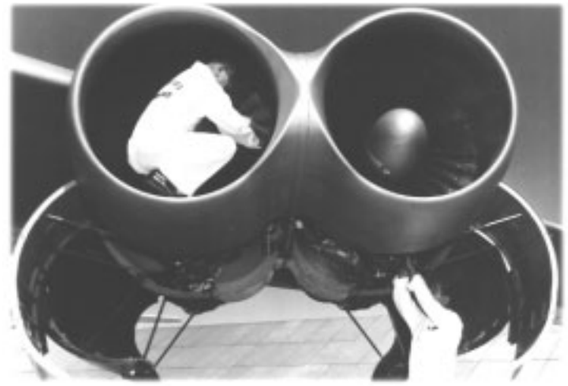
The base's involvement in the nuclear weapons program didn't end there, however. In the 1950s, the Oklahoma City Air Materiel Area, as it was then called, modified B-36s, B-50s and B-29s to carry atomic weapons.

Tinker also had a hand in the history-making Berlin Airlift. Tinker personnel established the maintenance and overhaul procedures for aircraft used in the airlift. The base's commanding officer and several Oklahoma City Air Materiel Area personnel deployed to Burtonwood, England, in 1948 to direct airlift maintenance support.

The responsibility for overhauling the largest single engine fighter in use by the U.S. Army Air Forces in World War II, the P-47, landed at Tinker also. Workers completed the first overhaul on the aircraft in 1947, getting the plane back into service after its long, hard journey as a bomber escort and ground attack aircraft in all theaters of the war.

Through the years

Throughout the following decades, bomber repair responsibilities became a Tinker trademark. The base has worked on or managed the B-1, B-17, B-24, B-25, B-26, B-29, B-30, B-36, B-47 and B-50. The center still provides depot maintenance and modification work for the B-52.



A B-52 eingine being repaired at Tinker AFB, Okla., in the 1950s. (Courtesy photo)

Even the stealthy B-2 has maintenance ties to the base. The B-2 Weapons System Support Center and the B-2 Avionics Repair Facility, the only one of its type in the Air Force, are located at Tinker.

The Air Force's E-3 Airborne Warning and Control System and the Navy's E-6 reconnaissance aircraft also depend on the OC-ALC for depot-level repairs and maintenance.

Propelling into the future

Today, the Oklahoma City Air Logistics Center is the largest jet intermediate maintenance center in the world, a title that has humble beginnings rooted in 1947 when overhaul responsibilities began on the J33 and J35 engines.

Since then, it has managed the F100, F101, F108, F110, F118, TF30, TF34, TF39, TF41, T400, T700, J33, J57, J69, J75, J79, J85, J56, T64 aircraft engines and F107 and F112 missile engines.

Although the centers contribution to aviation is evident in massive bombers and huge workloads, it can also be traced to the smallest details. Several airborne accessories — the items that make today's flying safer than ever before — are worked here. Oxygen equipment, hydraulics, fuel accessories, parachutes, ejection seats and other life support equipment are just a few examples.

Once inconceivable concepts and products have become the sustaining force behind the existence of Tinker today and the propelling force driving it toward aviation's future.

The Wright brothers got powered aircraft in the air and a hundred years later, the Oklahoma City Air Logistics Center is keeping them there.

— Ms. Amy Schiess, OC-ALC Public Affairs

1983 **June 13, 1983:** *Polneer 10* became the first spacecraft to leave the solar system.

1984 **July 1984** The first Harpoon (AGM-84) missile was delivered . The missile could be launched from a B-52 to destroy enemy ships.

1985 **Sept. 13, 1985:** The first anti-satellite intercept test took place when a weapon air-launched from an F-15 successfully destroyed a satellite orbiting at a speed of 17,500 mph, 290 miles up.

1986 **October 10, 1986:** The USAF placed the LGM-118A Peacekeeper or MX Missile, on alert duty. Each ICBM can deliver warheads to ten different targets.

1987 **Nov. 24, 1987:** A B-1B Lancer bomber records the first success of an air-launched cruise missile.

1988 **November 10, 1988:** The USAF revealed the F-117 Stealth fighter to the public for the first time.

1989 **June 14, 1989:** The Martin Marietta *Titan IV* heavy lift space booster, nearly 20 stories tall, launched into space for the first time.

1990 **May 4, 1990:** The AIM-120A advanced medium-range air-to-air missile passed its final flight test for use on USAF fighters.

1991 **December 21, 1991:** The Rockwell AC-130U Spectre gunship flew for the first time. The new-generation gunship combined increased firepower, reliability and accuracy with the latest target-location technology.

1992 **July 1, 1992:** Air Force Materiel Command is activated, replacing Air Force Logistics Command and Air Force Systems Command.

Bringing history 'up-to-date'

Nearly 100 years ago Orville and Wilbur Wright stood at Kitty Hawk, N.C., flipped a coin and flew into history. The first powered flight lasted 12 seconds and took Orville 120 feet.

A group of Utah State University engineering students, working with the Space Dynamics Laboratory at Hill Air Force Base, Utah, are marking that event in history by building a model of the 1905 Wright Flyer. The plane will get a 21st century makeover though as a lesson in engineering and fabrication.

Kevlar and graphite, composites manufactured in Utah and used in the Space Shuttle, will replace the fabric and spruce originally used. The flyer will weigh 400 pounds, 300 less than the original and cruise at 45 mph, 20 miles an hour faster than the original.

"We expect our version to fly farther, higher and faster than the original, which only had a 13 horse power engine with no carburetor," said Mr. Nick Alley, USU graduate student who is leading the 12-member undergraduate design team.

Improving on the best

"Their design was the best of its day, no question," he said. "When they pulled their plane back out after mothballing it for a few years and flew it at the Paris Airshow in 1908, the only reason they had to land was because they ran out of gas. That is how well they built their plane."

The students built and displayed a quarter-scale model, which they presented to state legislators and that was seen by Olympic visitors at various venues. Their presentation, The Wright Way to Fly, placed second at the Western Regional American Institute of Aeronautics and Astronautics Student Conference.

Now working with aviation maintenance and flight tech students from USU, the engineers are building their plane in anticipation of flying it at the Inventing Flight celebration at Dayton, Ohio, in July 2003.

"We're working a lot with the people who are going to build the plane," said Mr. Ben Case, an engineering student on the aerodynamics design team. "We would present them with an idea and they would give us input on how to make it better.

Ahead of their time

"One thing I think we've all learned is a good design is a redesign," he said. "The Wright Brothers were well ahead of their time, but we wanted to improve on the design, we're not just restoring it we're souping it up. There isn't a lot of engineering in building something that has already been done. The Wright brothers were concerned with lift not drag; we've reduced the weight by 40 percent and made the airfoils thicker to reduce stalls and drag. We'll be able to go higher because our gas tank is bigger. But when a person looks at the plane it will look like the 1905 Wright Flyer." The flyer will have two seats to allow for a pilot and a pilot trainer.

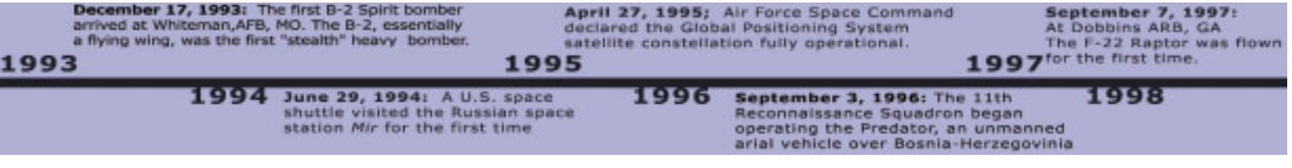
Top: Students at Utah State University, working with the Space Dynamics Laboratory at Hill AFB, Utah, are building a 1905 Wright Flyer replica with a 21st century makeover. Bottom: Mr. Charles Larson, left, and Mr. David Widauf look over part of the front rudder of the replica their students are constructing for the 100 year anniversary of the first powered flight. (Courtesy photo)

Lighting a 'fire'

"One of our goals with this project is to take the flyer on a tour of Utah, especially schools, in the hopes of lighting a fire of interest in engineering among our young people," said Mr. David Wildauf, executive director of the replica project and an associate professor in the industrial technology and education department at USU.

"Building a Wright Flyer is not only a once-in-a-lifetime opportunity for our student designers, it's an awesome educational outreach tool for Utah's children," he said.

— Mr. Gary Boyle, OO-ALC Public Affairs



Staff Sgt. Michael Leach, left, and Senior Airman Erik Carlson, 654th Combat Logistics Support Squadron, Tinker AFB, Okla., remove a water separator from a B-1B bomber which is to be used as a static display. (Photo by Ms. Margo Wright, OC-ALC)

Tinker receives B-1B Lancer for static display

TINKER AIR FORCE BASE, Okla. — It is rare when an Air Force pilot gets to see a weapon system be reduced in force over the course of their career. But such is the case with the B-1B test pilots of the 10th Flight Test Squadron here.

As part of the Air Force's plan to reduce the current fleet of 92 B-1B Lancer aircraft to 60 over the next several months, eight Air Force installations around the country, including Tinker, will receive one of the planes to be used as a static display.

The other 24 planes will be stored at the Aerospace Maintenance and Regeneration Center at Davis-Monthan AFB, Ariz.

— Reported by OC-ALC Public Affairs

AFIT receives approval for a $13 million renovation

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Air Force Institute of Technology is one step closer to the renovation of its graduate school, thanks to approval by the U.S. House of Representatives for $13 million in building upgrades. The funding was part of more than $38 million approved for construction projects here.

The project will provide for a building overhaul that will update classrooms to facilitate the use of state-of-the-art instructional technologies.

The bill will now go to the Senate for approval. The renovation is scheduled to begin in winter of 2003.

— Reported by AFIT Public Affairs

Combustion research promises cleaner engine

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — A new gas turbine combustor that increases engine performance while reducing exhaust emissions is being developed here by scientists and engineers in the Air Force Research Laboratory's Propulsion Directorate.

Working in conjunction with General Electric, researchers in the turbine engine division, combustion science branch, are developing new technologies that can reduce engine emissions without sacrificing enhanced performance. Trapped vortex combustion is one such technology.

Recent test results of a prototype indicate it can help meet the performance requirements for military applications while reducing overall emissions.

Significant emissions and performance improvements are expected with additional research and development of trapped vortex engines with the hope of transitioning the technology to frontline military as well as commercial gas turbine engines.

— Reported by AFRL Public Affairs

Officers given opportunity to gain field experience

HANSCOM AIR FORCE BASE, Mass. — An Electronic Systems Center initiative aims to fill voids in aerospace expeditionary force units by using volunteer company grade officers in career broadening roles.

Lt. Gen. Bill Looney, ESC commander, recognized that many young officers at Hanscom were not getting the opportunity to serve in a deployed capacity despite the fact that the Air Force was finding it difficult to fill some deployed positions.

After establishing a liaison with the aerospace expeditionary force center, or AEF, at Langley AFB, Va., a system was set up for collecting and matching volunteers.

When a tasking is generated by the AEF Center, ESC will check for a fill from that cycle's resource pool. The system draws from a ready trained pool and can handle normal as well as short notice taskings.

Some openings require previous experience or special duty identifiers; however, the vast majority can be filled by any energetic young officer ready to learn on his or her feet. The openings literally span the globe.

— Reported by ESC Public Affairs

Secretary Roche speaks at ALEW annual conference

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Air Force Secretary James Roche spoke here recently at the base's annual Acquisition and Logistics Excellence Week activities. He said recent events served as a catalyst to accelerate a transformation-type process already in place.

Transformation is "opening a window and letting some fresh air in" as America's military forces adapt to and overcome today's challenges, not simply putting yesterday's projects and programs under a new buzzword, he said.

Secretary Roche said one of the first steps in getting that freshness comes as Air Force operators begin a closer working relationship with acquisition professionals, communicating both ways.

He also lauded AFMC's work in spiral development — providing the warfighter a certain level of needed capability with the ability to add to that in the future, pieces at a time.

When it comes to transformation, Secretary Roche said the Air Force is a very agile organization. He said service leaders have made changes in Air Force doctrine, the service's planning process, how personnel experts detail officers, educational opportunities for enlisted men and women, how doctors are selected, how service schools are worked and, most recently, equipment.

Renaming the F-22 Raptor the F/A-22 and expanding its' role and previous work on the C-17 are equipment changes Roche cited as transformational foresight. These are examples of where he said Air Force acquisition needs to go.

— Reported by ASC Public Affairs

Tinker exceeds goals on KC-135

As the need for KC-135s continues to span across the globe, the ability of the air logistics center to support the warfighter becomes increasingly important.

When the programmed depot maintenance facilities had 176 aircraft waiting for repair two years ago from a fleet of 546 tankers, then Air Force Chief of Staff Michael Ryan believed that was too many. So he directed OC-ALC, leaders to reduce the number to fewer than 100 depot-possessed aircraft by the end of fiscal 2002.

Exceeding the goal

Tinker not only met the goal, they exceeded it. As of Sept. 30, the number of depot-possessed aircraft at all three maintenance facilities was 89.

Col. Dave Kelly, KC-135 System Program Office director, said the system program office developed a plan to reduce the size of the work package and to defer 34 aircraft from their five-year program depot maintenance cycle by designing an extension inspection program. This allowed the maintenance sites room to implement lean initiative maintenance processes and improvements to include how the aircraft flowed.

"There were just too many airplanes sitting and waiting for maintenance," he said. "They redid their production flow to make the work flow better — more efficiently."

Through this initiative, the time it takes from aircraft inspection to delivery back to the warfighter was cut in half from two years ago. "They just produced a jet in 179 days, down from 428," he said.

Providing tool kits

Part of that success was due to the Composite Tool Kits provided to the tanker flight preparation area, that significantly reduced the need for mechanics to travel from the aircraft on the ramp to the hangar for support equipment.

"The trick was getting the mechanic back on the airplane," said Mr. Mike Wenzel, tanker branch chief. "So, we had to get our parts under control."

Supervisors' mobile offices were added to the flight prep area to allow them to maintain contact with crews regardless of the location of aircraft on the ramp. This allowed the them to be proactive with the aircraft and employees.

After reaching improvements in quantity, Mr. Enarson, flight prep chief, began looking at quality by developing a customer satisfaction inspection, where technicians evaluate the quality deficiency reports from customers.

"This helps present a meticulously prepared aircraft to the Tanker Branch's primary customers, the aircrew of the 10th Flight Test Squadron and customers in the field," he said.

To become the crème de la crème of depots, the program office allowed maintenance to accomplish their improvements by giving them "breathing room," said Mr. Jack Srnec, KC-135 system program office deputy director.

Adding critical personnel

"For their part, they refined their processes and changed how they flow the aircraft," he said. "They also beefed up a second shift and they added personnel so they could burn more hours per airplane."

Mr. Wenzel hired 170 full-time critical skill workers. He also looked at how and where he deployed the mechanics during the workday.

"We used to work airplanes all over the base," he said. "When we had 51 airplanes on the base, we were dispatching mechanics everywhere. We weren't focusing on pushing the airplane out the door."

Today, maintenance is focused on moving the airplanes by having mechanics concentrate on a specific aircraft. "We're applying labor in the amount that we need to keep the aircraft flowing through the process," he said.

The focus has doubled efficiency and cut overtime hours in half.

"Overall, the KC-135 success story over the last two years is a great example of how a team effort can significantly improve our warfighter's capability to defend this country," said Col. Kelly. "Tinker has produced more programmed depot maintenance aircraft in fiscal 2002 than in the past seven years.

"I don't think people fully realize the enormity of the program and how well it has been executed," he said.

— Mr. Ray Dozier, OC-ALC Public Affairs

CV-22 wraps up electronic warfare testing at Edwards

The Air Force's CV-22 tilt-rotor recently completed electronic warfare testing in the Benefield Anechoic Facility at Edwards Air Force Base, Calif.

The purpose of the electronic warfare tests was to test the Suite of Integrated Radio Frequency Countermeasures, or SIRFC system, which is the radar warning receiver and electronic countermeasures system for the CV-22.

According to Maj. Greg Weber, the CV-22 government flight test director at Edwards, the testing was a great success.

"This last round of tests has basically verified that a lot of our design changes are giving us the type of performance that we're looking for," said Maj. Weber.

A building-block approach

Throughout testing in the Benefield Anechoic Facility, a building-block approach was used to learn from past testing and implement necessary changes for future tests. The test team started testing inside the facility with antenna pattern measurements.

"As is always the case, whenever you install antennas on the airplane and begin testing them, there are things that don't exactly work the way some models say they would," said Maj. Weber.

After adjustments to the antennas were made, the test team moved on to more than eight weeks of electronic warfare testing, where they examined the systems response to threat systems.

"In electronic warfare testing you get into some of the other performance-related items such as the angle of arrival, the accuracy of the threat information and threat response time," said Maj. Weber.

According to Mr. Rex Wade, Bell-Boeing's electronic warfare lead test engineer, some factors can't be effectively tested in the air, such as the interaction between the SIFRC system and the multi-mode radar system.

This type of testing is known as interoperability testing.

"Part of our testing is designed to find not only how well the system works, but also seeing how well it works in conjunction with other aircraft systems," said Mr. Wade. "So we had to make sure the multi-mode radar system and SIRFC system didn't hinder each other in performance."

Completing the analysis

The next step will be for Bell-Boeing to analyze the data from the tests and make recommendations to the CV-22 program office. Once analysis is complete, the test team will begin flight testing.

"Overall, the testing went exceptionally well," said Mr. Wade. "Everyone on the team put in a lot of hours and worked extremely hard, and we were able to gather a lot more data than we originally expected."

Top: The Air Force's CV-22 tilt-rotor is removed from the Benefield Anechoic Facility at Edwards AFB, Calif., recently after more than eight weeks of electronic warfare testing. The aircraft will now be prepared for open air testing. Bottom: The CV-22 is suspended in the anechoic chamber for the electronic warfare testing. (Photos by Mr. Rob Bardua, AFFTC Public Affairs)

And because of the success of the facility testing, this could be the last time the CV-22 ever needs to be tested in the Benefield Anechoic Facility, said Maj. Weber.

"Over the next year they may decide to tweak an antenna location or see if there's an effect that some of the new hardware will have, so there will always be an opportunity to go back to the anechoic facility," he said. "But as of right now, we don't anticipate a need to go back, and we're planning to move on to open air testing."

— Mr. Rob Bardua, AFFTC Public Affairs

Hanoi Taxi departs Robins after final maintenance stop

The Hanoi Taxi, the Air Forces flying tribute to the Vietnam War's prisoners of war and missing in action, recently received a makeover and a heros sendoff at Robins Air Force Base, Ga., before returning home.

This C-141 Starlifter was the first aircraft to airlift American POWs to freedom from Gia Lam Airport in Hanoi, North Vietnam, on Feb. 12, 1973.

The 445th Airlift Wing at Wright-Patterson AFB, Ohio, which owns the aircraft, asked Air Force Reserve Command headquarters officials for permission to repaint the aircraft in the 1970s white and gray paint scheme. AFRC officials approved and funded the work, which was done while the aircraft underwent programmed depot maintenance at Robins.

Air Force Reserve Maj. Gen. Edward Mechenbier, one of the POWs repatriated aboard the Hanoi Taxi, flew the historic aircraft from Robins back to Wright-Patterson.

"It was the most beautiful thing I had seen in six years," said Gen. Mechenbier, referring to the first time he saw the Hanoi Taxi. He is currently the mobilization assistant to the commander of Air Force Materiel Command.

A command pilot with more than 3,500 flying hours, Gen. Mechenbier was assigned to Da Nang Air Base, South Vietnam, and was on his 80th mission over North Vietnam when his F-4C Phantom II fighter was shot down in June 1967. He spent nearly six years as a POW before the Hanoi Taxi brought him home.

The Hanoi Taxis name comes from the writing on the flight engineer's panel by the POWs aboard the plane for the freedom flight. Signatures of the freed prisoners have been preserved on the panel over the years and are the centerpiece of what is essentially a "flying museum." Plaques, documents and photographs of the homecoming are part of the on-board exhibit researched and created by the 445th AW. Etchings of the names of those who are missing in action were taken from the Vietnam Wall in Washington and are mounted on the plane.

"The Hanoi Taxi is a tribute to the men and women who serve in the Air Force," Gen. Mechenbier said. The general added that it is important for the American public to know about the airplane and what it means to the nation.

The aircraft, which has been upgraded to a C-141C with improved avionics, is used to transport troops and cargo worldwide. It is one of four C-141s flown by the 445th AW that were involved in Operation Homecoming, the repatriation of American POWs in the Vietnam War.

All C-141s are scheduled to be retired from the Air Force inventory by 2006.

— Courtesy of AFRC News Service

Maj. Gen. Edward Mechenbier talks about what the Hanoi Taxi means as an Air Force pilot and former prisoner of war as it leaves Robins AFB, Ga., and heads home to Wright-Patterson AFB, Ohio. (Photo by Ms. Sue Sapp, WR-ALC Public Affairs)

First lady urges military members to consider teaching after retirement

The birthplace of aviation recently became a launching pad for career possibilities as America's first lady encouraged departing military members here to consider "another call" from the Defense Department's Troops to Teachers program.

During her visit, Mrs. Laura Bush recognized educators and the potential roles departing military members can play in education. Approximately 1,300 people attended the rally along with several base, local and state leaders, members of Congress and Troops to Teachers participants and their students.

Helping the future

"Our children are the future," the former grade school teacher and librarian told the crowd. "Ensuring they have the best education possible and the chance to realize their dreams is our greatest obligation. As soldiers, you pledged yourself to duty, honor and country — and your service will never be forgotten. Today, I ask you to pledge yourselves to our children, the future of this country. I ask our retiring men and women to answer a new call — the call to teach."

Troops to Teachers is a program that assists select people who want to begin a career in public education upon departing the military. It began in 1994, and nearly 4,000 veterans have been hired into the nation's schools since.

A projected shortage

Last January, "No Child Left Behind Act" legislation authorized the program to continue for five more years as officials estimate 2 million new teachers will be needed in the next decade.

Three teachers, Mr. Eusebio Bretado Jr. of El Paso, Texas; Mr. William Byrd of Madison, Ala.; and Mr. Michael Glaze of Beaufort, S.C.; proved successful Troops to Teachers examples as each received excellence in teaching awards at the rally.

Two Dayton school teachers, Mr. Greg Powell and Mr. Melvin Early, are Air Force retirees who left Wright-Patterson and went into Troops to Teachers. They are the types of role models being sought for the program, according to Mrs. Bush.

"And Wright-Patterson has no shortage of them," she said. "Members of the military have always been tremendous role models — you possess the greatest in character, commitment and resolve. And today, our children need those qualities more than ever."

Mrs. Bush said coming to Wright-Patterson was an easy choice for the presentation.

"We really wanted to be here for this event," she said. "I visit a lot of bases around the world to talk to troops about when they retire from the military to continue to serve their country as teachers.

"Today we heard some really wonderful stories about teachers in the Ohio area. We really picked Ohio today because of Wright-Patterson," she said.

First lady Laura Bush speaks to Air Force members about the Defense Department's Troops to Teachers program recently at Wright-Patterson AFB, Ohio. The Oct. 16 rally drew 1,300 service members. (Photo by Mr. Spencer Lane, ASC Public Affairs)

A rewarding profession

Mrs. Bush is heavily involved in promoting several educational programs as well as reading programs throughout the country. She taught second, third and fourth grades in Texas, and earned a graduate degree in library science and worked as a school librarian in her career.

She said she missed the work. She also admitted it wasn't always easy, but added there weren't many professions as rewarding as teaching when you succeed.

"Those years were very satisfying," she said. "Teaching might be very difficult, but there's also never a boring moment when you have 20 little kids around you all the time."

— Mr. Brett Turner, ASC Public Affairs

Racecar: The Science of Speed

AFRL science showcased at museum

Strap on a helmet and get in gear. Air Force Research Laboratory technologies to improve racecar driver protection are currently being featured as part of a special exhibit at the Boonshoft Museum of Discovery in Dayton.

The museum exhibit, called "Racecar: The Science of Speed," explores the science behind Indy and NASCAR auto racing in an interactive learning environment. Featuring a Winston Cup racecar and a 1990 Porsche Indy car, Science of Speed opened Sept. 8 and continues through Jan. 12, 2003. The AFRL display reflects a portion of the exhibit that highlights safety systems and advancements in the racecar industry.

Researching injuries

AFRL's Human Effectiveness and Materials and Manufacturing Directorates have created displays demonstrating their work on projects researching how to reduce driver and spectator injuries during crashes.

Through a cooperative research and development agreement with Trice Motorsports, the human effectiveness directorate is collecting data on head and neck injuries using tiny sensors mounted in driver's helmets and earplugs.

"We are analyzing the data to define impact tolerance and injury causation to better understand what causes certain injuries such as concussion," said Mr. Ted Knox, principal scientist with the directorate's biodynamics and accelerationbranch. "The information will also benefit pilots and civilian drivers."

So far, several racecar drivers such as former Indianapolis racing champion Mr. Greg Ray, have used the helmet on various tracks. Mr. Knox said scientists will collect the data until 2007. The display at the museum depicting this research shows the two types of sensors placed in driver's helmets and earplugs, along with a crash data recorder used to record the acceleration of tested racecars during a crash.

Also on display is a special tether incorporating an original fiber material technology for racecars. Developed by the materials and manufacturing directorate, and known as Polybenzobisoxazole, or PBO, and commercially known as Zylon^{tm}, it dramatically strengthens the tether.

Directorate scientists originally developed the sturdy material for high temperature Air Force needs. Similar in design to steel cables that support large suspension bridges, the cables consist of about 10,000 individual PBO fibers.

According to materials and manufacturing directorate scientist Ms. Marilyn Unroe, in 1999 the Indy Racing League required that every car competing in the Indy 500 be equipped with a new suspension and wheel energy management system, which utilizes the Zylon^{tm} tether to minimize the risk of wheels flying off during crashes.

Like a 'good neighbor'

"Motorsports is a traditional portal through which Air Force technology has been introduced into the civilian economy, multiplying the value of the taxpayers' investment," said Mr. Paul Lane, Jr., Dayton Society of Natural History Board of Trustees.

"Local citizens need to know their Air Force neighbors are supporting technology development beyond military applications," said Mr. Lane. "In addition, the Boonshoft is a prime environment to fire their children's minds with the exciting science and engineering research at AFRL."

— Ms. Larine Barr, AFRL Public Affairs

She could have 'danced all night'

If an attorney at Brooks City-Base, Texas, could have her way she would do more than the old popular song "I Could Have Danced All Night" suggests. For now, she is content in filling much of her off-duty time preparing for and competing in ballroom dancing.

"I've always loved to dance," said Capt. Julie Jiru who trained in ballet and tap dancing as a youngster. However, the 28-year-old Brooks Staff Judge Advocate lawyer has come a long way from her early years imitating the jazz dancing moves of entertainer Paula Abdul to competing at the professional level in ballroom dancing's Latin competition.

In March, she competed in Houston at the Texas Challenge Dance Sport Championship. "We finished second in our division. We had never competed together. I had never danced at that level," she said of her partnering with San Antonio radio disc jockey Mr. Jason McClellan. The pair spent four months preparing to compete in two classic Latin dances: the rumba and cha cha.

"The last time I had competed was five years ago in college," Capt. Jiru admits. Enhancing her anxiety was the complexity of the Latin motions that their coach had choreographed. "It's innovative and flashier. That's the type of dancing Jason and I do."

Precise timing and reacting quickly to changing situations on the dance floor are two key elements she learned when she began ballroom dancing as a freshman in college. Her campus ballroom dance club participation initially provided her training in classic ballroom dances. She eventually became enamored with American rhythm which encompasses the more flamboyant and passionately expressive Latin dances.

She didn't 'miss a beat'

She resumed her ballroom dancing career after earning a law degree and Air Force commission, not missing a beat when she returned to competition. However, she now knows the full meaning conveyed in the Dance Sport Championship's moniker "Texas Challenge."

"Something funny happened," she said about a miscue that occurred. "The cha cha was first, but a samba beat came on. Someone had keyed up the wrong music. I started to move around, but then the music was cut off." While their concentration was momentarily interrupted, she and her partner recovered.

"With all of the excitement and energy of competing, the hardest thing to do is keeping the timing to certain beats. You also have to make sure you don't run into other dancers," she explains. Their freestyle type choreography posed an even greater challenge to them.

"You begin a Latin dance apart from your partner," she said, explaining that "breaking" a term describing the beginning of a movement, must be executed on every beat. Dancers average about 100 separate movements during musical numbers. The dance team must have enough choreographed material to precisely cover a two-minute rumba routine and one-and-a-half minutes for cha cha.

"I was gasping for breath. Your mouth goes dry," she said in describing the condition she was in after her high-energy performance. Competitors are given only ten seconds rest between dances.

Nevertheless, she enjoyed the thrill of competing again. "It's a huge commitment," she said of the time, money and resources devoted to ballroom dancing.

Among the finer details associated with this entertainment activity are dancers' costumes. For men, tailored outfits are designed for both esthetics and utility. "Their tuxedos are custom-made without shoulder pads so that their shoulders don't appear to rise when they raise their arms. It's done to preserve a 'top line' image," she said. Her "Texas Challenge" dress was hand-made by a San Antonio designer. Its design is based on Latin dance motions that accentuate hip and leg action.

Planning for future competitions

"The most important thing is getting a good coach and trainer. When you practice, you can't get discouraged. It's very tiring and a lot of work, but it's also very rewarding."

Capt. Jiru has found a great dance partner in Mr. McClellan and equally inspiring coach in Mr. Cardenas. Now the trio is devoted to improving their technique as they plan for future competitions later this year. Ultimately, she wants to compete at the national level in such high-profile events as the Ohio Star Ball.

Elevating Capt. Jiru's performance at that level would be her version of "dancing on cloud nine."

— Mr. Rudy Purificato, 311th HSW

Capt. Julie Jiru, an attorney at Brooks City-Base, Texas, and her dance partner, Mr. Jason McClellan, practice moves with their coach, Mr. Esteban Cardenas. The couple took second place in their division in the Texas Challenge Dance Sport Championship. (Photo by Tech. Sgt. Pedro Ybunez)

Superstition aside, octogenarian flies 'first' at Robins Aero Club

Overcast skies and a threat of afternoon showers on Friday the 13th didn't stop Mr. Harry Rickenbacker from making his maiden flight with the Aero Club at Robins Air Force Base, Ga., in September.

Instead, the peppy 83-year-old stepped proudly onto the runway and smiled as the memory of his first flight decades ago came to mind.

Finding a new love

"I love flying, and I always did, but had never tried it on my own" he said. "One day while my wife and I were driving down the highway we rode past a flight school. She told me, 'you know what, you need a hobby.' I pulled over, turned around and took my very first lesson."

That was 1962, he was 42 years old and a new love for flight was born.

Though he was a little shaky when he took those first lessons, he said a little while later, he had his pilot's license and was soaring solo.

Mr. Rickenbacker's daughter, Ms. Kay Broom, said that through the years, her father has flown with several aero clubs but this was his first time with Robins'.

"He is very excited," she said. "As long as he is in the air, he's happy."

A friend of Broom's, Mr. Mike Hogan who is a contractor at Robins, helped orchestrate the day's events.

"My father and Mike became fast friends when they learned they both had a love of airplanes," said Ms. Broom. "Ever since that day they have talked for hours about planes and flying."

Mr. Ron Dawes, aero club pilot, said that he was happy to accommodate Mr. Rickenbacker and the day's flight was left up to him. "He said he wants to get a view of the base from the air, but whatever he wants to do is fine with me," said Mr. Dawes.

Family roots in aviation

Mr. Dawes said Mr. Rickenbacker's ancestry piqued his interest as he was once stationed at the Air Force base named after his uncle, the World War I flying ace Capt. Eddie Rickenbacker. The base has since been closed.

Capt. Rickenbacker is known as the top American Ace pilot credited with 26 aerial victories in only two months of combat flying.

Though his nephew may not have his accolades the love for flying is in his blood.

A plane with a 'view'

With camcorder in hand to record his day in the clouds, Mr. Rickenbacker stepped onto the aircraft, waved goodbye and prepared for takeoff.

"Back when I did most of my flying, I didn't have a movie camera to record it," he said with a smile. This time he made sure it was all on record bringing along a 35 mm camera to boot. Though he didn't take the wheel, he enjoyed an hour-long sightseeing tour of Robins and Middle Georgia.

After the flight, his daughter said he went home to watch his tape and share the experience with his friends. "He really loved it," she said. "He had a great time."

— Ms. Lanorris Askew, WR-ALC Public Affairs

Order of the Sword:

AFMC commander presented enlisted members' highest honor

More than 300 enlisted members gathered at the Air Force Museum at Wright-Patterson Air Force Base, Ohio, Nov. 7 to usher the Air Force Materiel Command commander into Air Force history as one of only 207 people inducted into the Order of the Sword.

Only the fifth person inducted in the AFMC Order of the Sword, Gen. Lester Lyles attended with his wife and all four of his children. Present and former command chief master sergeants; former Air Force Systems Command commande and Order of the Sword recipient Gen. Benard Randolph; and various AFMC leaders also watched the command's enlisted members crown Gen. Lyles as the "enlisted person's general."

The Order of the Sword dates beyond the Air Force, back to the 1500s and the days of kings and noblemen, said Chief Master Sergeant of the Air Force Gerald Murray during the ceremony. Ancient warrior leaders would, on occasion, honor a leader and pledge their loyalty by ceremoniously presenting him a sword.

"The enlisted corps holds the Order of the Sword near to its heart and reserves it only for those who have impacted them in a way deserving of this recognition," Chief Murray said. "We bestow this recognition on great leaders who make the youngest airman feel like an intimate part of their vision. Their obvious passion for the mission and the people who perform it draws followers to them and keeps them committed."

Chief Murray's comments followed a ceremony filled with the pomp and circumstance seemingly only military ceremonies can offer — the presentation of the nearly 6 foot sword, a proclamation and citation recording Gen. Lyles' induction and the presentation by ceremony committee members of a lead crystal decanter bearing the Order of the Sword emblem and Gen. Lyles' name to commemorate the event.

Impressive achievements

Since taking command of AFMC in April 2000, Gen. Lyles has racked up an impressive list of accomplishments geared toward the enlisted force, said Chief Master Sgt. David Mimms, AFMC command chief. These include providing a discretionary checkbook totaling more than $500,000 directly to command chiefs across the command to support airmen as they saw fit; providing more than $150,000 to AFMC Airman Leadership Schools for technical upgrades; providing the senior NCO academy and each stateside NCO academy $15,000 to establish AFMC focus rooms for student support; providing more than $220,000 in fallout funds for command chief quality-of-life projects; and funding more than $6 million to support families around the command via the Year of the Family initiative.

Additionally, the chief said Gen. Lyles sought the enlisted perspective and insistently adjusted his schedule to meet with chiefs' groups and junior airman forums to hear their views.

"Our United States Air Force, and our nation, is truly blessed when endowed with leaders who possess insight, wisdom and the ability to inspire in people the determination to pursue and achieve the highest in human goals, accomplishments and values," Chief Mimms said. With that, a very humbled Gen. Lyles took the podium.

Humbled and honored

"I'm speechless," he said. "I'm extremely honored and humbled to be the recipient of this very prestigious and very time-honored award. I really just want to say thank you to all of you." Considering himself merely a Redskins fan from Washington, D.C., Gen. Lyles said what's special about where the Air Force is today is the blessing and honor to serve "this great nation, in this fantastic organization we call the United States Air Force and with all of you.

"That, to me, is the No.1 thing of all," Gen. Lyles said, looking at the sword. "It's symbolic of what is most important in this Air Force — our people, in particularly our enlisted corps.

"I am very humbled to be the recipient of this Order of the Sword presentation, but I accept it on your behalf. Not because of anything I may have done, but because of what all of you represent. You are the ones who should be dealt the gratitude and the thanks for the sacrifices you and your peers make every day for our Air Force, Air Force Materiel Command and for this great country."

Staying the course

Gen. Lyles also recognized the commitment that comes with the Order of the Sword induction — a commitment of legacy of the Air Force, what the Order of the Sword represents, but also to stay the course relative to Air Force men and women.

"I accept that commitment and pledge to you that I'll continue to give and give as hard as I can to support all of you in what you represent — the men and women of this great institution," he said.

— Tech. Sgt. Carl Norman, AFMC Public Affairs

Chief Master Sgt. David Mimms, AFMC command chief, presents the Order of the Sword to Gen. Lester Lyles, AFMC commander, during a Nov 7 ceremony at the Air Force Museu, Wright-Patterson AFB, Ohio.